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MARINE CORPS JOINT ASSIGNMENT MODEL
UNDER TITLE IV OF THE
GOLDWATER-NICHOLS ACT OF 1986

by

Richard L. Miller

September 1989

Thesis Adivisor: Paul R. Milch

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REPORT DOCUMENTATION PAGE

eport Security Classification Unclassified		1b Restrictive Markings	
ecurity Classification Authority		3 Distribution Availability of Report	
)eclassification Downgrading Schedule		Approved for public release; distribution is unlimited.	
rforming Organization Report Number(s)		5 Monitoring Organization Report Number(s)	
ame of Performing Organization al Postgraduate School	6b Office Symbol *(if applicable)* 55	7a Name of Monitoring Organization Naval Postgraduate School	
ddress *(city, state, and ZIP code)* nterey, CA 93943-5000		7b Address *(city, state, and ZIP code)* Monterey, CA 93943-5000	
ame of Funding Sponsoring Organization	8b Office Symbol *(if applicable)*	9 Procurement Instrument Identification Number	
ddress *(city, state, and ZIP code)*		10 Source of Funding Numbers	
		Program Element No / Project No / Task No / Work Unit Accession No	

itle *(include security classification)* MARINE CORPS JOINT ASSIGNMENT MODEL UNDER TITLE IV OF THE LDWATER-NICHOLS ACT OF 1986

ersonal Author(s) Richard L. Miller

Type of Report	13b Time Covered	14 Date of Report *(year, month, day)*	15 Page Count
ster's Thesis	From To	September 1989	68

upplementary Notation The views expressed in this thesis are those of the author and do not reflect the official policy or po-n of the Department of Defense or the U.S. Government.

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	Group	Subgroup	DOD Reorganization Act, Push/Pull Manpower Model

bstract *(continue on reverse if necessary and identify by block number)*

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ame of Responsible Individual l R. Milch	22b Telephone *(include Area code)* (408) 646-2882	22c Office Symbol 55Mh

ORM 1473,84 MAR 83 APR edition may be used until exhausted
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security classification of this page

Unclassified

T245566

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Marine Corps Joint Assignment Model Under Title IV of the Goldwater-Nichols Act of 1986

by

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Major, United States Marine Corps
B.S., Northern Illinois University 1976

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
September 1989

ABSTRACT

This thesis reviews the requirements imposed on Marine Corps manpower managers by Title IV of the Goldwater-Nichols Department of Defense Reorganization Act of 1986. An interactive computer program, TITLEIV, is introduced as a tool which manpower managers can use to forecast the effect of manpower decisions in regards to compliance with Title IV regulations. The model uses a "push-pull" process which pushes officers with joint duty experience through their Marine Corps career and pulls officers into joint duty billets. Several billet strategies were developed to demonstrate the models flexibility and potential use to manpower managers.

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THESIS DISCLAIMER

The reader is cautioned that computer programs developed in this research may not have been exercised for all cases of interest. While every effort has been made, within the time available, to ensure that the programs are free of computational and logic errors, they cannot be considered validated. Any application of these programs without additional verification is at the risk of the user.

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I. INTRODUCTION

A. BACKGROUND

On 1 October 1986 the Goldwater-Nichols Department of Defense Reorganization Act became law. Its purpose is:

> To reorganize the Department of Defense and strengthen civilian authority in the Department of Defense, to improve the military advice provided to the President, the National Security Council, and the Secretary of Defense, to place clear responsibility on the commanders of the unified and specified commands for the accomplishment of missions assigned to those commands and ensure that the authority of those commanders is fully commensurate with that responsibility, to increase attention to the formulation of strategy and to contigency planning, to provide for more efficient use of defense resources, to improve joint officer management policies, otherwise to enhance the effectiveness of military operations and improve the management and administration of the Department of Defense, and for other purposes. [Ref. 1]

The Reorganization Act is an attempt by Congress to correct perceived inter-service coordination problems within the Department of Defense which were highlighted in the Iranian hostage raid and the Grenada invasion. The Senate Armed Services Committee investigations and hearings prior to the Reorganization Act found that part of the coordination problems was caused by the Services placing inexperienced officers on the joint staffs and a high turnover rate of officers assigned to the staffs. Officers on these joint staffs were found not to possess the skills and talents necessary to represent their own service and did not have the education and experience necessary to assist a joint command. Additionally, the length of time an officer was in a joint tour was found to be too short, resulting in a lack of continuity within the command.

Title IV of the Reorganization Act establishes the framework all services must follow in managing officers assigned to joint commands, placing demands on the services to ensure that officers assigned to joint commands have the necessary qualifications and remain with the command for a specified tour length. A key provision of the Reorganization Act is the formation of a Joint Duty Assignment (JDA) list on which there are currently 8,400 billets. For a billet to qualify as a member of the JDA list it must be:

> . . . an assignment to a designated position in a multi-service or multi-national command or activity that is involved in the integrated employment or support of the land, sea and air forces of at least two of the three Military Departments. [Ref. 2: p. 17]

The Marine Corps is currently responsible for filling 451 JDA billets. This number may be changed as joint commands are formed and disbanded. Table 1 shows the breakdown of the current Marine Corps JDA billets by grade and Appendix A has the detailed breakdown of JDA billets by Military Occupational Specialty (MOS) and grade. JDA billets are subdivided into two categories, labeled 9701 and 9702. A billet in the 9702 category is termed a Critical JDA billet and requires the officer chosen to fill the billet to have the necessary grade and MOS and additionally to have been designated a Joint Specialist Officer (JSO). To be considered eligible for the designation as a JSO an officer must have completed the prescribed course of Joint Professional Military Education (JPME) at the Armed Forces Staff College and to have completed a JDA tour, in a 9701 billet, where the officer was designated a JSO nominee. The Marine Corps presently is responsible for filling 59 of its 451 JDA billets with officers designated as JSOs.

Table 1. USMC JDA RANK REQUIREMENTS

RANK	O4	O5	O6	O7
9701 (Non-Critical Billets)	153	173	50	16
9702 (Critical Billets)	0	28	30	1

There are two paths a Marine Corps officer can follow in becoming a JSO. The first sequence requires the officer to first complete JPME and then complete a full JDA tour as a designated JSO nominee. The sequence of education and then JDA tour must be adhered to under Title IV rules. The second path is for officers who have what is termed a Critical Occupational Specialty (COS). Title IV defines a COS as: "Those specialties engaged in the operational art to attain strategic goals in a theater of conflict through the design, organization, and conduct of campaigns and major operations." [Ref. 3: p. IV-1] For the Marine Corps, an officer who has the MOS of Infantry, Artillery, Combat Engineer, Track, Air Control Air Defense, or Aviation (03, 08, 13, 18, 72, 75) is considered to be a COS officer. Provisions under Title IV allow the officer with a COS MOS to be designated as a JSO nominee without having to meet the requirement of completing a joint education first. If that COS officer is to be considered for a second JDA tour as a JSO, the officer must complete the requirement of receiving a formal education in joint matters. Additionally, an officer with a COS MOS is allowed to serve a two year

JDA tour instead of the standard three year tour. "Such designations are intended to ensure that normal tour length requirements for joint duty assignments do not lead to significant deterioration of warfighting skills or personnel shortages in operational fields." [Ref. 3: p. IV-1]

The joint education required for JSO nominees and JSO's consists of a two phase curriculum. The first phase of the joint education process is conducted at all service schools. Marine officers receive the first phase of a joint education at Command and Staff College or the Naval War College. The second phase is conducted at the Armed Forces Staff College, consisting of a nine and five week course for majors and lieutenant colonels respectively.

B. TITLE IV CONSTRAINTS

Title IV of the Reorganization Act has specific rules which the Services must follow for filling JDA billets and the promotion prospects for officers with JDA experience.

Approximately 50% of the Marine Corps JDA billets, around 225 billets, must be filled by JSOs or JSO nominees. This requirement is the congressional attempt of ensuring Marine officers have the proper education or have the relevant Marine combat specialty to assist a joint staff. Title IV has placed a limit on the number of COS JSO nominees who have not had JPME at 25% of the JDA billets requiring JSO or JSO nominees. For the Marine Corps this currently means a maximum of 56 COS officers without JPME can fill JDA billets as JSO nominees.

Title IV requires computation of the annual average length of JDA tours and requires the average to be at least three years. This is the average tour length of all officers who have left a JDA tour during the past fiscal year. A maximum of 12.5% of all JDA assignments can be excluded from the averaging of tour lengths. This exclusion applies only to officers with a COS MOS who were on an initial JDA tour and were released from a JDA billet after completing a minimum of 24 months of duty. Using the present list of 451 billets the Marine Corps can have up to 56 COS officers per year leave their first tour JDA billet after serving two years and not effect the Title IV goal of maintaining a three year average. The 12.5% rule is the way Congress keeps the military services from flooding JDA billets with two year tours, which would defeat the congressional concern for continuity.

An officer with a COS MOS who has served a two year JDA tour as a JSO nominee has an increased chance of being required to perform a second JDA tour as a designated JSO. Title IV stipulates "Of officers selected for the joint specialty on the basis of hav-

ing served a 2-year COS tour, an appropriate percentage must return for a full tour in a critical JDA billet." [Ref. 3: p. IV-2] The "appropriate percentage" is equal to the ratio of the total number of COS officers who have completed two year tours as JSO nominees to that of all officers who have completed JDA tours as JSO nominees.

The overall concern of Title IV is the requirement for quality officers to fill JDA billets. Title IV mandates the Secretary of Defense to take an active role in the management of the Title IV constraints. The Secretary of Defense is now responsible in overseeing the careers of officers who are or have held JDA billets and Marine Corps personnel managers must report to the Secertary of Defense the status of all Marine officers with joint experience. This report must include what billets Marine officers with JDA experience are filling and the promotion rate of these officers. The Secretary of Defense will scrutinize the report to ensure Marine officers with JDA experience are given billets which keep them competitive with officers without JDA experience and are promoted at a rate equal to or greater than their peers who have not had a JDA tour. Title IV has another requirement ensuring that quality officers fill JDA billets by stipulating only colonels who have completed a JDA tour are eligible for promotion to brigadier general.

C. REASON FOR A MODEL

There are previous studies which have modeled the impact of Title IV on individual Services. Two studies [Refs: 4, 5] focused on the impact of Title IV on the career paths of a specific group of officers in the Navy, the Surface Warfare Officer (SWO) Specialist. The latter of these two studies used a semi-Markov process, as described by Milch [Ref: 6], to determine career paths based on a sequence of tours a SWO could encounter throughout the officer's career. An Army study [Ref: 7] used the concept of tracking a cohort of Army Command and Staff College graduates through a career path network. Finally, a Center for Naval Analysis (CNA) study [Ref: 8] was used to develop " ... a plan to fill "critical" joint billets and meet the fill-rate requirement under the provision of the DOD Reorganization Act." [Ref: 8: p. 4]. The CNA model was developed for Navy planners to help them determine the effects promotion rates and shifts in JDA assignments in the O-4, O-5, and O-6 grades (Lcmdr, Cmdr and Capt) have on the number of Navy O-6's eligible for promotion to O-7.

While each of the studies has merit in what effect Title IV has on the Army or the Navy, the CNA study comes closest to the needs of Marine Corps Manpower planners. This model enables "what if" type of questions to be answered concerning changes in

promotion rates and in the mix of majors, lieutenant colonels and colonels to be used to fill JDA billets. However, the CNA study does not fully address some of the finer points of Title IV concerning the use of the COS specialty.

The burden of tracking officers with JPME, JDA experience and the compliance to Title IV rules rests with Marine Corps personnel managers. Any deviation from the Title IV constraints, as well as what actions are underway to correct for the deviation must be addressed in the Marine Corps annual report to Congress. Marine Corps manpower managers need a tool to enable them to monitor compliance with Title IV regulations before the problems occur or become too complex to solve.

II. MODEL

A. INTRODUCTION

In the three years since the enactment, various committees have been formed within the Office of the Secretary of Defense to interpret the requirements of the Act and formulate procedures for the Services to use in order to comply with the Title IV constraints. Some of these procedures, especially those concerning JPME, have made the manpower manager's task simpler. However, since the Act is still in its infancy, there are questions which remain unanswered since there are no historical data as of yet to analyze.

Marine Corps Manpower managers require a model which captures the substance of Title IV by simulating the filling of JDA billets and tracking the careers of officers with JDA experience. In the model presented in this thesis these two distinct processes are combined in what is called a "Push-Pull sequence" [Ref: 9: p. 8]. Openings for JDA billets pull officers into the billets and officers who have completed JDA tours are placed into select JDA manpower pools where they are then pushed through the ranks. The set of JDA billets can be viewed as the driver for the entire system. The completions of tours in JDA billets represent the accessions to the JDA manpower pools.

B. DESCRIPTION

The model TITLEIV is a menu driven, interactive analytical model written in APL (A Programming Language) for use on an IBM PC which has APL software installed. The purpose of the model is to show the user the outcome, with regard to Title IV constraints, of the JDA billet fill strategy the user has selected. The model is based on the concept of tracking personnel in JDA billets and personnel who have previous JDA experience on a year to year basis for the number of years the user requests to forecast.

Within the model there are eight distinct categories of JDA billets and seven types of joint manpower pools for the user to change and use as inputs to the model. The user can distribute the total number of JDA billets the Marine Corps is responsible for filling among the eight billet categories. Table 2 contains the list of the eight categories and defines the qualifications required of the officers to fill each particular billet category. The seven joint manpower pools, see TABLE 3, represent the Marine officers who are not currently in a JDA billet but have special joint duty attributes or qualifications based

on their past JDA tour which set them apart from other Marine officers who do not have JDA experience.

TITLEIV represents the numbers of billets in each billet category in a matrix format. The rows of a particular matrix corresponds to that billet's tour length in years. Thus a billet with a tour length of three years would be represented by a matrix with three rows. The columns of each of the billet categories represent the years of commissioned service (YCS) of the Marine officers who start a tour in that billet category. There are fourteen columns in each matrix which represent the YCS of Marine field grade officers, with 13-17, 18-22 and 23-26 YCS representing the ranks of major, lieutenant colonel and colonel respectively in accordance with current Marine Corps promotion policies. An example of a three year JDA billet category matrix, namely that for JSO nominee, is given in Figure 1. If JSO nominee billets at the start of YCS 19 are open, officers with that same YCS, are pulled into the first row of that column. At the start of the second year in the tour, the officers holding those billets are shifted to the second row of the same column. In this example the officers who started their JSO nominee tour at YCS 19 will complete their tour at the end of their 21st YCS but are still shown in the column for YCS 19 during their third year in the billet.

The matrices for billet categories 3, 4, 7 and 8 are of the same shape as the one shown in Figure 1; whereas for billet catgories 2, 5 and 6 the matrices have only two rows.

The joint manpower pools are represented by a single seven by fourteen matrix. Table 3 contains the description of each JDA manpower pool represented by the rows of the matrix, as shown by Figure 2. Each column of the matrix represents officers with the same YCS starting with the rank of major at YCS thirteen. Officers within a given row in the joint manpower matrix have the same level of joint experience.

Joint manpower pools receive officers leaving their previous tour in a JDA billet at the appropriate YCS of the officer. This allows the model to keep officers with the same YCS and JDA experience together as a coherent group. As an example, Figure 3 shows how officers who started a three year "JDA" billet at the beginning of YCS 20 would enter the "JDA" manpower pool at YCS 23 along with officers within the "JDA" manpower pool from YCS twenty-two.

Table 2. BILLET TYPE DEFINITIONS

1. **JDA**:
   50% of the billets do not require any special qualifications or designations of the officers who fill these billets. A COS officer can be used to fill one of these billets but the tour length is three years.

2. **JDA-COS**:
   This billet is similar to the above category execept this JDA billet is filled by a COS officer who is in the billet for two years only.

3. **JSO nominee**:
   An inititial JDA tour in a billet which requires an officer who has been designated as a nominee and has completed JPME prior to the starting the tour. A three year tour.

4. **COS JSO nominee (3 yr - no JPME)**:
   A billet which is filled for three years by a JSO nominee who has a COS MOS but the officer does not have JPME education.

5. **COS JSO nominee (2 yr - no JPME)**:
   A billet which is filled by a JSO nominee who has a COS MOS but the officer does not have JPME. The billet is held for two years.

6. **COS JSO nominee (2 yr - JPME)**:
   A billet which is filled by a JSO nominee who has a COS MOS, has had JPME but holds the billet for two years.

7. **JSO**:
   A billet category which requires an officer in his/her second JDA tour who completed JPME and then was designated as a JSO nominee during an initial JDA tour. A three year tour.

8. **CRITICAL**:
   A JDA billet which has been designated as being critical under the terms of Title IV and can be filled only by JSOs who were COS JSO nominees or JSO nominees. An appropriate number of two year COS JSO nominees must fill these Critical JDA billets. These billets comprise a three year tour.

A continuation rate matrix is used with the joint manpower pool matrix to push existing pools of officers within the manpower pools into the next model year. Promotions from major to lieutenant colonel and lietenant colonel to colonel are made at YCS 17 and 22 respectively.

Table 3. POOL DEFINITIONS

1. **JDA:**
   Officers who have had one three year tour in a JDA billet but were not designated as a JSO nominee. This group also includes the officers who have a COS MOS but were not designated as a JSO nominee when they held their JDA billet.
2. **JDA Two Year COS:**
   Officers who have a COS MOS filling a JDA billet for two years. These officers are counted against the 12.5% exemption from averaging.
3. **JSO nominee:**
   Officers who have completed the sequence of JPME and then were designated as JSO nominees in their first tour.
4. **COS JSO nominee (3 yr - no JPME):**
   Officers with a COS MOS who have been designated as a JSO nominee and have completed a standard length tour but did not receive JPME.
5. **COS JSO nominee (2 yr - no JPME):**
   Officers with a COS MOS who completed a two year tour in a JDA billet as a JSO nominee but have not completed JPME.
6. **COS JSO nominee (2 yr - JPME):**
   Officers with a COS MOS who have been designated as a JSO nominee. went to JPME and then completed a two year tour in a JDA billet.
7. **JSO:**
   Officers who have had JPME and two tours in a JDA billet in which the officer was designated a JSO nominee in the first tour and designated a JSO in the second tour.

C. VARIABLES

The seperation of JDA billets into eight categories and manpower pools of officers with JDA experience into seven pools allows the model to perform the calculations necessary to check the compliance of Title IV constraints to a given mix of officers assigned to a fixed number of JDA billets in the presence of existing joint manpower pools.

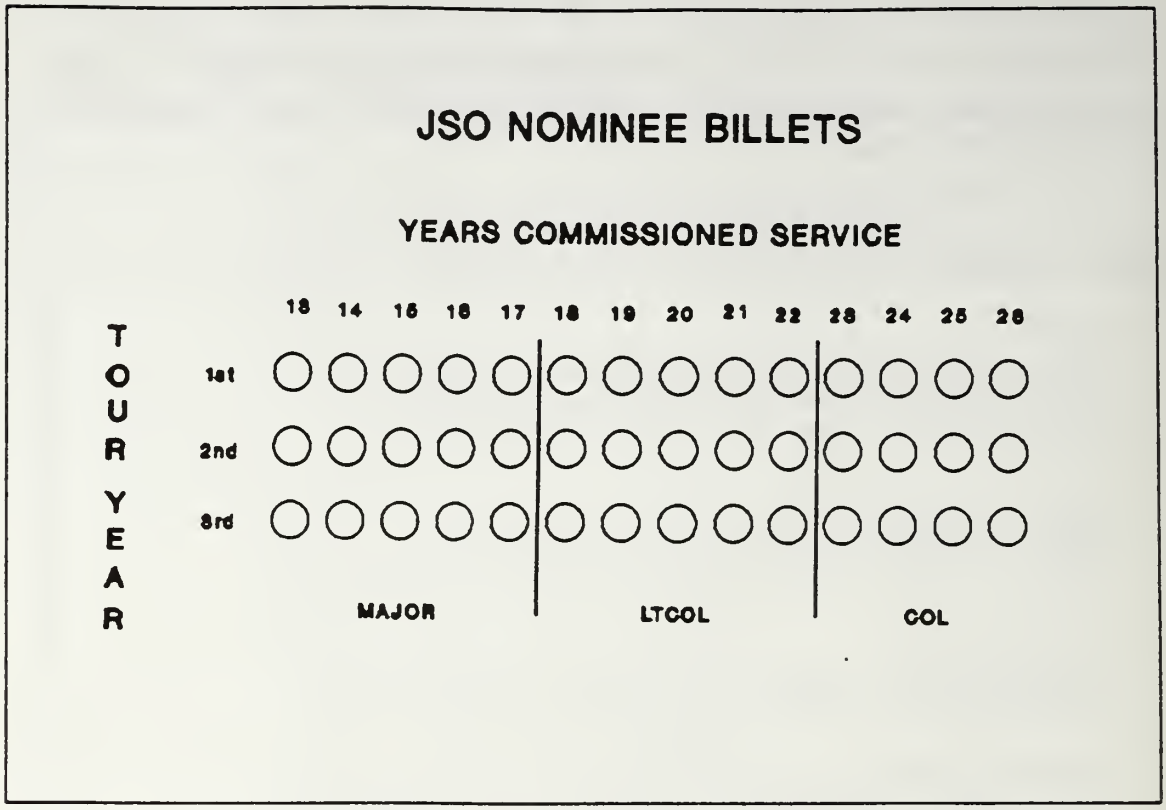


Figure 1. JSO Nominee Billet Matrix

1. USER VARIABLES

The user supplies the model with the following information:

POOL A 7 × 14 matrix consisting of the numbers of Marine officers with previous JDA experience. The rows represent the types of manpower pool and the columns the YCS of the officers with JDA experience from the rank of major to the rank of colonel.

BILLET There are three 2 × 14 and five 3 × 14 matricies depending on the tour length of the billet category. Columns of the matrix represent the YCS of the officers who enter the first year of the tour and the rows represent the number of years or tour length of the JDA billet.

CR A 14 × 14 Markov probability matrix which is used to advance officers in any of the pools to the next YCS. Advancements from YCS 17 and 22 represent the promotion of majors to lieutenant colonel and lieutenant colonels to colonel respectively.

EXCLUSION The Title IV constraint of the percentage of the total number of billets which can be excluded from the yearly averaging of tour lengths of officers who have left a JDA billet at the completion of a model year. This exclusion only applies to COS officers who complete at least a two year joint billet.

Figure 2. Pool Matrix

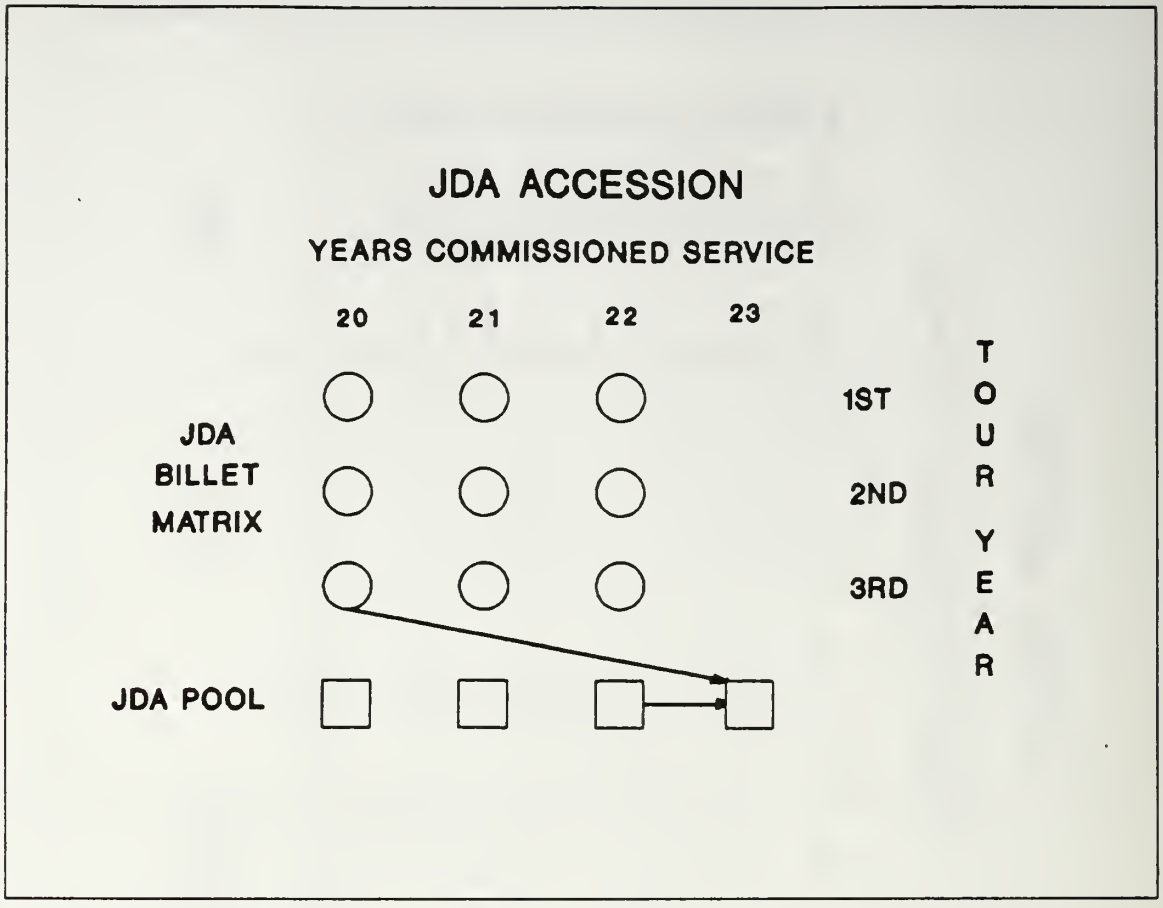


Figure 3. Transition Into a Manpower Pool

2. INDEX USAGE

The model uses the following indicies:

i — Billet categories 1 through 8 given in Table 1 or the Manpower pools 1 through 7 given in Table 2.

j — The year of commisioned service of the officers. The values of 13-17, 18-22 and 23-26 represent the YCS of the officers with the ranks of major, lieutenant colonel and colonel respectively.

k — The year in a billet tour. Values of 1, 2 and 1, 2, 3 represent billets with tour lengths of two and three year tours.

t — The model year for which to forecast.

D. PUSH-PULL CALCULATIONS

Manpower pools are updated on a yearly basis. Officers with JDA experience and the same YCS are pushed forward to the next year and officers leaving JDA billets are

added to the pools at their appropriate YCS as accessions by the continuation rate specified in the *CR* matrix. The elements of the matrix **CR** are defined as:

$$\mathbf{CR}_{j,s} = \begin{cases} \mathbf{C}_j & \text{if } s = j+1 \\ 0 & \text{otherwise} \end{cases}$$

i.e. $\mathbf{C}_j$ are the rates of transfer from j to j+1 YCS.

The number of billets in the eight JDA billet categories are represented by the variables $\mathbf{BILLET}_{i,j,k}$ defined as:

$\mathbf{BILLET}_{i,j,k}(t)$ = the number of billets of category i which are filled by officers who are in their kth year in the billet and in their (j+k-1)th YCS, in model year t.

The eight types of JDA billets rotate through a two or three year cycle where each billet in its first year of the cycle goes to its second year, then its third year, if any, after which it goes to its first year again, etc.

For i = 1, 3, 4, 7, 8:

$$\mathbf{BILLET}_{i,j,2}(t) = \mathbf{BILLET}_{i,j,1}(t-1)$$

$$\mathbf{BILLET}_{i,j,3}(t) = \mathbf{BILLET}_{i,j,2}(t-1)$$

$$\mathbf{BILLET}_{i,j,1}(t) = \mathbf{BILLET}_{i,j,3}(t-1)$$

For i = 2, 5, 6:

$$\mathbf{BILLET}_{i,j,2}(t) = \mathbf{BILLET}_{i,j,1}(t-1)$$

$$\mathbf{BILLET}_{i,j,1}(t) = \mathbf{BILLET}_{i,j,2}(t-1)$$

The last year of a billet category also represents the number of billets of that type which will become vacant at the completion of a fiscal year.

Elements of the matrix $\mathbf{POOL}(t)$ are defined as:

$\mathbf{POOL}_{i,j}(t)$ = the number of officers in POOL *i* with j YCS. at time t.

The yearly update of the manpower pools for pools 1, 2, 4, and 7 are accomplished by a two step process consisting of advancing officers within these pools from one YCS to the next at the specified continuation rate, then adding accessions from the corresponding billets. These accessions are officers with JDA experience who have successfully transitioned from a JDA tour to the appropriate YCS at the specified continuation rate.

For i = 1, 4:

$$\mathbf{POOL}_{i,j}(t) = \mathbf{C}_{j-1} \times \mathbf{POOL}_{i,j-1}(t-1) + \mathbf{C}_{j-1} \times \mathbf{BILLET}_{i,j-3,3}(t-1)$$

$$\mathbf{POOL}_{2,j}(t) = \mathbf{C}_{j-1} \times \mathbf{POOL}_{2,j-1}(t-1) + \mathbf{C}_{j-1} \times \mathbf{BILLET}_{2,j-2,2}(t-1)$$

and

$$\mathbf{POOL}_{7,j}(t) = \mathbf{C}_{j-1} \times \mathbf{POOL}_{7,j-1}(t-1) + \mathbf{C}_{j-1} \times \left(\sum_{i=7}^{8} \mathbf{BILLET}_{i,j-3,3}(t-1) \right)$$

For all of the above equations the index j represents the YCS of the officers in the pools, ranging from 13 to 26.

The process for the yearly update of the pools 3, 5 and 6 is more complex because these are the pools from which officers can be qualified to fill (as a second tour as a Joint Specialty Officer) billet categories 7 and 8. This process consists of advancing all the elements in the three pools to the next YCS by the specified continuation rate, then pulling specific numbers of officers from these pools to fill billets as Joint Specialty Officers and finally adding the accessions from the like billets who have transitioned to the appropriate YCS at the specified continuation rates.

This process is described by the following six step algorithm:

STEP 1:

The three manpower pools, i = 3, 5, 6 are first updated by the appropriate continuation rates. These pools now represent the numbers of officers who are eligible to become Joint Specialty Officers for the new fiscal year. Compute:

$$\mathbf{POOL'}_{3,j}(t) = \mathbf{C}_{j-1} \times \mathbf{POOL}_{3,j-1}(t-1)$$

and

$$\mathbf{POOL'}_{i,j}(t) = C_{j-1} \times \mathbf{POOL}_{i,j-1}(t-1) \qquad \text{for i} = 5, 6$$

STEP 2:

Title IV requires an appropriate percentage of the open **CRITICAL** billets (Category 8) in the fiscal year to be filled by two year COS JSO nominees. Calculate the required number of COS officers to fill **CRITICAL** billets for a fiscal year as given by the following equation:

$$\mathbf{COSJSO}(t) = \left(\frac{\sum_{i=5,6} \sum_{j} \mathbf{POOL'}_{i,j}(t-1)}{\sum_{i=3,5,6} \sum_{j} \mathbf{POOL'}_{i,j}(t-1)} \right) \times \sum_{j} \mathbf{BILLET}_{8,j,3}(t-1)$$

STEP 3:

The model uses an iterative method of spreading the filling of **CRITICAL** billets, as evenly as possible, among the COS JSO nominee pools, starting with the most senior YCS where a **CRITICAL** billet vacancy exists.

The process starts with the model finding the senior YCS j where a **CRITICAL** billet is to be filled during the fiscal year. The model then checks if $\mathbf{POOL'}_{i,j}(t)$, for i = 5 or 6 and j equal to the senior YCS with an open **CRITICAL** billet, have at least one officer in either pool. If this condition is true the model selects the pool with the larger number of officers for the given YCS. In case of a tie pool 6 is selected since officers in this pool have had JPME. Then the following sequence occurs:

(i) the number of open **CRITICAL** billets for the given YCS is reduced by one;

(ii) the number of officers from the given YCS of the selected pool is reduced by one;

(iii) the variable **COSJSO** is reduced by one.

If the above condition of at least one officer in at least one of the two pools for the same YCS is not met or the sequence of filling an open **CRITICAL** billet with an officer is complete, the model searches for the next most senior YCS in which a **CRITICAL** billet is open and repeats the process described above. After completing this procedure in the most junior open **CRITICAL** billet the process returns to the most senior YCS where a **CRITICAL** billet is open. As long as the number of COS officers required to fill billets, **COSJSO**, is not zero and there are COS officers in the pools who are eligible to fill the open **CRITICAL** billets, the model will continue to iterate. The iteration stops when the

variable **COSJSO** is zero or there are not any officers available in the pools specified for any YCS of an open **CRITICAL** billet. The latter causes the model to issue a flag to show that the constraint of filling **CRITICAL** billets with the required number of COS JSO nominees was not met.

STEP 4:

$\mathbf{POOL}'_i(t)$ for i = 5, 6 now represent the officers who have not been chosen to become Joint Specialist Officers for the fiscal year. These two pools now complete their updating by adding to them the officers leaving billet category 5 or 6 (depending on the pool type being updated) as expressed by the following equation:

$$\mathbf{POOL}_{i,j}(t) = \mathbf{POOL}'_{i,j-1}(t-1) + C_{j-1} \times \mathbf{BILLET}_{i,j-2,2}(t-1) \quad \text{for i} = 5,6 \qquad (5)$$

STEP 5:

The manpower pool responsible for filling the remaining **CRITICAL** billets is now pool 3, the JSO nominee pool. For each YCS j for which there are **CRITICAL** billets open, the number of officers needed to fill those billets are subtracted from the corresponding $\mathbf{POOL}'_{3,j}(t)$. If the value of $\mathbf{POOL}'_{3,j}(t)$ for any j becomes negative, the value is reset to zero and a warning issued to show that there were not enough officers in the pool to fill open **CRITICAL** billets at a specific YCS j.

STEP 6:

Step 5 is now repeated for the vacant billets from the **JSO** billet category using the officers remaining in pool 3. Here too if $\mathbf{POOL}'_{3,j}(t)$ becomes negative it is reset to zero and a warning triggered to show that there were not enough officers from the pool to fill specific open **JSO** billets. $\mathbf{POOL}'_{3,j}(t)$ now represents the numbers of officers for the fiscal year who have not been chosen to become Joint Specialist Officers. The pool is finally updated by adding the officers leaving billet category 3 as expressed by the following equation:

$$\mathbf{POOL}_{3,j}(t) = \mathbf{POOL}'_{3,j-1}(t-1) + C_{j-1} \times \mathbf{BILLET}_{3,j-3,3}(t-1) \qquad (6)$$

The process of updating the pools is now complete.

During the pulling of officers from the pools described in Step 3 above, the model will not accept a fraction of an officer to fill a **CRITICAL** billet. This was an arbitrary

decision for the model but one which takes the conservative approach regarding the number of officers in these pools.

E. JPME CALCULATIONS

An issue of concern to the manpower manager is JPME. Any COS JSO nominees who do not have JPME, from pool 5, selected to fill a **Critical** billet must receive JPME to qualify as a JSO. To help the manpower managers plan for the number of JPME slots needed to meet the billet fill requirements for the forecasted year the number of COS officers needing JPME in order to fill JSO billets is computed and added to the number of first tour officers needing JPME.

F. TOUR LENGTH AVERAGE

An important task required of the manpower managers is that of calculating the average tour length of the officers who have completed their joint duty assignment during a given fiscal year. Only COS officers who have completed a minimum of a two year JDA tour are exempted from the averaging but there is a maximum number of COS officers which can be excluded. This number is based on the users input value for the variable **EXCLUSION** defined earlier.

To calculate the average tour length for a fiscal year the following variables are used:

TNB = The total number of JDA billets the Marine Corps must fill.

EX = The maximum number of two year COS billets which can be exluded.

NOTEXCLUDED = The number of COS officers filling a two year billet tour who have completed their JDA tour and are above the maximum number allowed to be excluded from the annual averaging of tour lengths.

$$\mathbf{TNB} = \sum_{i} \sum_{j} \sum_{k} \mathbf{BILLET}_{i,j,k}$$

$$\mathbf{EX} = \mathbf{TNB} \times \mathbf{EXCLUSION}$$

$$\mathbf{NOTEXCLUDED}\,(t) = \max \left[0 , \sum_{i=2,5,6} \sum_{j} \mathbf{BILLET}_{i,j,2}\,(t-1) - \mathbf{EX} \right]$$

Using the above variables, the average tour length for the completion of a fiscal year, **AVGTOUR**, is computed as follows:

$$\mathbf{AVGTOUR}(t) = \frac{3 \times \sum_{i=1,3,4,7,8} \sum_{j} \mathbf{BILLET}_{i,j,3}(t-1) + 2 \times \mathbf{NOTEXCLUDED}(t)}{\sum_{i=1,3,4,7,8} \sum_{j} \mathbf{BILLET}_{i,j,3}(t-1) + \mathbf{NOTEXCLUDED}(t)}$$

G. ASSUMPTIONS

There are several assumptions which are utilized by the model developed for this thesis.

- The continuation rates do not affect officers within joint billets until their tours are complete. Essentially, these officers are assumed to be insulated from the outside world. If the officer's tour overlaps a promotion zone, the model considers the officer as being automatically promoted at the completion of the officer's JDA tour. This assumption is reasonable considering the screening process used in the selection of officers to JDA billets.
- All joint billets are assumed to be 100% filled. The problem of filling billets in the model occurs if there are not enough officers in COS JSO nominee and JSO nominee pools to fill **CRITICAL** and **JSO** billets. In such cases the model issues the user a warning that there is a problem of not enough qualified officers available for the billet fill selected but assumes the billets are filled by officers who do not have the joint experience necessary to fill the billets but have been granted waivers in order to fill the billets. Title IV allows waivers to be given on a case by case basis by the Secretary of Defense.
- Officers who are not continued from one YCS to the next are dropped from the model. These officers represent those who have been passed over for promotion or have been discharged from the Marine Corps and as such are no longer relevant to Title IV.
- The model does not deal with the promotion of colonels to brigadier general or the billets held by general officers. The model only tracks field grade officers to their 26th YCS. The number of colonels with joint experience at YCS 26 are tallied and given to the user as the number of colonels who would be considered eligible for promotion to general under Title IV rules. Then the colonels in the pools at YCS 26 are dropped from the model and colonels still in JDA billets after YCS 26 continue in their billets until their tour is complete.
- Tour lengths of joint billets are either two or three years in length depending on billet category. Fractions of years are not considered by the model.
- The method used in filling **CRITICAL** billets with officers from the COS JSO nominee pools selects the highest YCS where a **CRITICAL** billet can be filled from a COS JSO nominee pool and pulls one officer from that pool. Then the process goes to the next highest YCS where a **CRITICAL** billet can be filled and repeats the process until the required number of COS JSO nominees designated for a

CRITICAL billet has been met. This method spreads the **CRITICAL** billet fill across the available manpower pools of COS JSO nominees.

H. RESULTS ANALYSIS

The information needed to conduct an effective analysis of the inputs with regard to Title IV constraints is available to the user at two distinct areas in the model. The first area of information the user has available to analyze is the billet fill strategy the user has selected (see Billet Breakdown in Appendix B). This gives the user feedback concerning the total number of billets the user has specified, the percent JSO and JSO nominee fill of the total number of billets and the percentage of COS JSO nominees without JPME to the total number of billets. The second area in which information is available for the user to analyze occurs after the model has been run (see Run Analysis in Appendix B). The user is provided the following information:

1. The number of officers needing JPME to be qualified to fill JDA billets for the forecast year.
2. The number of colonels with JDA experience at YCS 24 to give the user an idea of the number of colonels who would be eligible for promotion to general under Title IV rules.
3. The average tour length. An average tour length less than three years indicates the user has selected more two year COS officers in the billet fill than can be excluded from the yearly averaging.
4. The number of Critical billets not filled by the required number of officers from the COS JSO nominee pools along with the total number of CRITICAL and JSO billets left unfilled.

In each case where the analysis shows there is a shortage of officers to fill the billet categories of **CRITICAL** and **JSO**, the model has predicted there will be an inadequate supply of JSO nominees from pool 3 to meet the demand created by the open billets for **CRITICAL** and **JSO**. To correct the model for anticipated shortages the user has several options available:

1. Change the YCS officers start **CRITICAL** and **JSO** categories to coincide with the YCS of the **JSO nominee** pool which shows a supply of officers available to become Joint Specialist officers.
2. Change the continuation rate to increase the number of officers available in the manpower pools.
3. Change the JSO nominee and two year COS nominee billet strategy to increase the number of officers in the corresponding manpower pools.
4. Some combination of the above.

The user can run the model again with the changes to test how the new values effect Title IV. This process can be repeated again and again until the user is satisfied with the results of a run.

I. SUMMARY

The model developed for this thesis is designed to provide answers to "what if" questions concerning compliance with Title IV regulations. The model will give the Marine Corps manpower managers an understanding of how decisions which change JDA billet fill and JDA manpower pools effect Title IV compliance.

III. ANALYSIS

A. INTRODUCTION

The model, TITLEIV, is structured around eight mutually exclusive joint billet categories and seven manpower pools. By time stepping the inputs for the billets and manpower pools into the future, the push-pull process of the model can be used to forecast how the inputs have complied with the constraints of Title IV.

When Marine Corps manpower managers are developing a billet fill strategy, they must focus particular attention on billets which are in the **CRITICAL** and **JSO** billet categories. These billets require officers who have been "grown" within the joint duty assignment system to become eligible for the designation of Joint Specialist Officer. This development requires that the interaction among the numbers of officers in JSO nominee billets, the JSO nominee pools and the billet fill requirements for **CRITICAL** and **JSO** billets be taken into account. A miscalculation in the supply or demand of officers qualified to be designated as Joint Specialist Officers could later result in a shortage of officers to fill these billets. Such a shortage would lead to the billets being filled by officers who do not have the qualifications needed. These officers would be required to have waivers, which are granted by the Secretary of Defense on a limited basis, in order to fill the open billets. A goal of a JDA billet fill strategy is not to have to resort to the use of these waivers. Waivers should be used only to cover the unexpected occurrences that may exist from time to time.

The following examples of billet fill strategies demonstrates the models usefullness in analyzing their compliance with Title IV constraints. Both examples presented in this thesis use the Joint Duty Assignment rank requirements specified for the billets in Table 1, for officers in the grade of major, lieutenant colonel and colonel. The two strategies differ in how these 434 billets are divided over the eight possible billet categories, but in both cases the same maximum number of COS officers that can fill two year COS JSO billets is used (54), as is the maximum number of COS officers which can be excluded from the yearly averaging of tour lengths (54). Each example starts its run with zero incumbents in the manpower pools to demonstrate the amount of time needed for each strategy to become self-sufficient in filling **CRITICAL** and **JSO** billet categories.

Both strategies were run using three different continuation rates. The first run used the continuation rates of .65 and .5 applied at YCS 17 and 23 respectively which are the

promotion zones for lieutenant colonel and colonel. The two other runs were made using continuation rates which reflect a more liberal promotion policy resulting in continuation rates of .70 and .60 for run two and .75 and .65 for run three for YCS 17 and 23 respectively. The more liberal promotion rates were used to show the effect of the promotion policy, stipulated in Title IV allowing officers with JDA experience to be promoted at a rate greater than their peers who do not have JDA experience. The continuation rates for the YCS's other than 17 and 23 were fixed at .99.

B. STRATEGY I

This strategy is developed to demonstrate a billet fill which will comply with Title IV constraints without resorting to the use of waivers within a few years after implementation. This is accomplished by generating a supply of officers who can be qualified as Joint Specialist Officers as quickly as possible and creating a demand for these officers as early a YCS as possible. The billet allocation for Strategy I, by billet category, for the 434 Marine Corps JDA billets is shown in Appendix C.

The billets of billet categories 3 and 6, **JSO nominee** and **COS JSO nominee (2yr-No JPME)**, are used to generate the officers eligible to become Joint Specialist officers. Billet categories 7 and 8, **CRITICAL** and **JSO**, have billets which are filled by officers who have been recently promoted to the grades of lieutenant colonel and colonel.

Two of the billet categories are not used in this strategy. Billet category 4, **COS JSO nominee (3yr-No JPME)**, is not used since the manpower pool it generates, pool 4, is not utilized by the model. Billet category 6, **COS JSO (2yr-JPME)** is not used in this strategy in order to keep the billet fill strategy simple.

Table 4 shows the results of the three runs using the differing continuation rates. It tables the shortages of qualified Joint Specialist Officers which occurred over a five year model run time. The shortage of Joint Specialist Officers for a model year is defined as the number of **CRITICAL** and **JSO** billets which the model did not fill with JSO nominees. Using the current promotion rates in the first run, the billet strategy became completely self-sufficient (i.e. did not require waivers to qualify officers), five years after the strategy was initiated. Changing the continuation rates to reflect a more liberal promotion policies for the second and third runs resulted in the billet strategy becoming self-sufficient within four years of implementation.

Additional information provided by the model on this billet strategy involves the number of colonels eligible for promotion to brigadier general and the number of JPME slots needed for filling vacant billets. The number of eligible colonels reaches its peak

and then levels out at model year 13 with values of 53, 60 and 66 colonels for runs one, two and three respectively. The number of JPME slots needed for this strategy varies between a requirement for 31 and 32 JPME slots needed per year. This is well within the 70 JPME slots per year currently available to the Marine Corps.

Table 4. SHORTAGE OF JOINT SPECIALISTS

STRATEGY I	MODEL YEAR				
	1	2	3	4	5
RUN 1	23	9	4	1	0
RUN 2	23	8	4	0	0
RUN 3	23	8	3	0	0

C. STRATEGY IIA

This strategy is developed to demonstrate a billet fill which uses all of the available billet categories of the model and is shown in Appendix D. The user must realize that using all the billet categories will reduce the number of billets that can be used to generate Joint Specialist Officers and will entail the model to be run for a longer period of time before the strategy can become self-sufficient. This is illustrated in the results of the runs of Strategy IIA shown in Table 5. The model had to run 11 years at the current promotion rate to become self-sufficient, compared with Strategy I which required five years. Another factor in the time required to become self-sufficient for Strategy IIA is the use of senior colonels in CRITICAL billets. It takes a longer period of time to push pools of qualified officers to be in a position to fill these senior billets.

The number of colonels eligible for promotion to brigadier general peaks and levels out at year 13 with a value of 60, 66 and 72 colonels for runs one, two and three respectively. Also the yearly number of officers required to have JPME to fill joint duty billets is 34, which again, is well below the current ceiling imposed on the Marine Corps for JPME school slots.

Table 5. SHORTAGE OF JOINT SPECIALISTS

STRATGEY IIA	MODEL YEAR										
	1	2	3	4	5	6	7	8	9	10	11
RUN 1	24	14	7	5	4	2	3	2	1	1	0
RUN 2	24	8	6	4	2	3	3	1	1	0	0
RUN 3	24	8	6	4	2	1	0	0	0	0	0

D. STRATEGY IIB

Congress realized at the time of enactment of the Goldwater-Nichols Act that the Marine Corps could not immediately comply with the requirements of Title IV with regard to filling joint duty billets with Joint Specialist Officers, and allowed the Marine Corps to designate a number of officers as potential Joint Specialty Officers to be used during the start-up phase of Title IV. Using data (Table 6) provided by Headquarters, Marine Corps on the number of officers who have been granted this waiver, Strategy IIA was run using these designated officers as incumbents in pool 3, **JSO nominee**. Using the current promotion rates the model showed there would be a shortage of JSO nominees from pool 3, at year eight of the model run. In this case pool 3 showed no incumbents at YCS 21 whereas pools 5 and 6 showed there were officers from either of these pools which could have filled the open billet. The user has three options available in dealing with this situation:

1. The first option is to do nothing, of course realizing that the billet would be filled by an officer who needed a waiver from the Secretary of Defense.
2. The second option requires the model to be stopped at year eight and the user must remove an officer with 21 YCS from either pool 5 or 6. This action means the user is filling the open billet with a COS JSO nominee.
3. The third option available is to use the model to explore the possibilities of achieving Title IV compliance by shifting the number of billets within a billet category from one YCS to another; or transfering a number of billets from one billet category to another category; or by changing the continuation rates in an attempt to keep more officers within the manpower pools.

For this case option three from above was selected. A transfer of six lieutenant colonel billets from the **JSO** category to the **JSO nominee** billet category was made, as shown in Appendix E. This simple change in the billet fill structure from Strategy IIA resulted in a new billet strategy called Strategy IIB. It results in no requirements to use waivers.

Table 6. CURRENT JSO NOMINEE INCUMBENTS

POOL	YCS													
	13	14	15	16	17	18	19	20	21	22	23	24	25	26
JSO NOMI-NEE	1	6	8	36	26	42	67	52	61	51	49	87	39	48

E. CONCLUSION

This brief introduction to the model demonstrated the flexiblity of the model in answering questions about how billet fill, manpower pools and continuation rates affect the joint duty assignment system.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The purpose of this thesis was to demonstrate the usefulness of the model, TITLEIV, as an analytical decision aid for Marine Corps Manpower managers in regard to compliance with the Goldwater-Nichols Department of Defense Reorganization Act of 1986. Two different joint duty assignment billet fill strategies were developed, as examples for demonstration purposes, to show how the model works. The first strategy used JDA billets which would cause the model to become self-sufficient in the shortest possible time. The second strategy was designed as a type of JDA billet fill the user could possibly use for exploration. Both strategies used the rank requirements of the current joint billet structure but differed in how the eight joint assignment billet categories were used. Using the "push-pull" process of pushing officers through their careers by YCS and pulling officers with specific YCS into vacant joint duty billets, the model was able to forecast each strategy's compliance to Title IV rules.

In the analysis of both strategy's the focus was on how soon a strategy would become self-sufficient if the model started with no officers residing in the manpower pools as incumbents. Each strategy was run using different promotion rates to see the effect on the time that a strategy would become self-sustaining.

B. CONCLUSIONS

In both strategies, after starting with zero incumbents in the manpower pools, increasing the promotion rate for lieutenant colonel from 65% to 70% and for colonel from 50% to 55%, dramatically reduced the amount of time a strategy took to achieve self-sufficiency.

Additionally, the current number of officers available to serve as potential Joint Specialist Officers was used as a set of incumbents. This deals with the problem of initial shortages of JSO's which occurred using the second strategy, Strategy IIA. This lead to a demonstration of how a user could use the model to perform "what if" type of analyses. The billet fill structure of Strategy IIA was changed to that of Strategy IIB, where Strategy IIB resulted in no shortages of qualified Joint Specialist Officers.

C. RECOMMENDATIONS

Congressional attention has been and will continue to be focused on how well the Marine Corps and the other services are complying with Title IV of the Goldwater-Nichols Act. Marine Corps manpower managers will be required to answer tough congressional inquieries concerning any possible violations of the Title IV regulations. Additional studies of the Act are needed so the managers can prevent violations by making timely decisions based on the results of the analyses.

The present model can be modified to allow manpower managers the ability to focus their attention on a set of billets which require officers from a specific MOS to fill the billets. The modification would require additional billet categories and their corresponding pool types to represent the officers of a particular MOS as they progress through their careers. As an example, Appendix A shows the 2602 MOS field, Signal Intelligence, as being required to fill six 9701 billets (non-Critical) and two 9702 billets (Critical) from their community. The officers who fill the two 9702 billets can come from the pool of officers who have filled one of the six 9701 billets or from a pool of officers, with the 2602 MOS, who completed a tour as a JSO nominee in billets other than the six billets listed. In this case three additional billet categories would be added to the model: one category for the two 9702 billets, one category for the six 9701 billets and one category for the billets other officers with the 2602 MOS can fill as JSO nominees. Additional manpower pools would be needed to track the officers from the 2602 MOS with joint experience through their careers. The officers in these pools would now represent the potential manpower from which to draw officers of the 2602 MOS into the two 9702 billets. With additional modifications to the computations performed by the model, the user could experiment with different billet fill strategies for this MOS and others.

The models current algorithm for selecting Joint Specialist Officers was selected for its simplicity. This method may not give the user the best selection of officers to fill billets as Joint Specialists. A modification to the model would be the incorporation of an optimizer routine. The optimizer routine could be used to maximize the number of CRITICAL and JSO billets filled by officers from the JSO nominee manpower pools.

APPENDIX A. JDA LIST

Table 7. USMC JDA BILLETS

DESCRIPTION	MOS	9701 (Non-Critical)				9702 (Critical)			
		O4	O5	O6	O7	O4	O5	O6	O7
ADJUTANT	0180	3	1						
INTELL	0202	18	19				2		
TACTICAL INTEL	0205	2							
COUNTER IN-TELL	0210	3	1						
INF OFF	0302	9	11				1		
LOGISTICS O	0402	9	13				1		
FIELD ARTY	0802	1							
NAVAL GFP	0840		1						
FAC MANAGE-MENT	1330	1	1						
AMMO O	2340	1							
COMM O	2502	12	9				4		
SIG INT	2602	6	2				2		
ELEC MAINT	2802		1						
GRD SUP O	3002	8	8						
DATA SYS O	4002	4	1						
PUBLIC AFF	4302	3	1						
JUDGE ADV	4402	2	2						
NBC O	5702	1							
M.P.	5803	1							
AAW	7204		1						
AIR DEF CON-TROL	7210	1	2						
VMA A-4	7501		2						
AV8-A C	7508	1							
A-6	7511		1						

Table 7 USMC JDA BILLETS (CONTINUED)

DESCRIPTION	MOS	9701 (Non-Critical)				9702 (Critical)			
		O4	O5	O6	O7	O4	O5	O6	O7
F4-S	7522	1							
F/A-18	7523		2						
RF-4B	7545	1							
UC-12B	7555	4							
KC-130	7557	1							
EA-6B EWO	7588	2	1						
AV SAFETY	7596	1							
ED OFFICER	9602	1							
DATA SYS MAN	9648	1							
OPS ANALYST	9650	1	2						
DEF SYS ANALYST	9652		2						
SYS ACQ MAN	9656		1						
C^3	9658	2							
SPACE OPS	9666	1	1						
INT'L REL	9676		1						
GENERAL OFF	9903				16				1
COL. LOGIST	9904			6				3	
COL. GRD	9906			17				10	
COL. NA NFO	9907			10				3	
UNRESTRICTED	9910	26	59	17			10	14	
UNRESTR GRD	9911	8	13				2		
NA NFO	9912	11	13				5		
AIR CONTROL	9930	4							
ACQ MANAGEMENT	9958	1							

APPENDIX B. SAMPLE RUN

A. MAIN MENU OPTIONS

```
                              TITLE IV MENU

TYPE THE LETTER IN PARANTHESIS TO REVIEW, CHANGE OR RUN MODEL INPUTS
                              (G)ET A FILE
                              (B)ILLET FILL
                              (O)FFICER POOLS
                              (C)ONTINUATION RATES
                              (T)ITLE IV EXCLUSION PERCENTAGE
                              (R)UN MODEL
                              (L)OOK AT CURRENT INPUTS/ANALYSIS OF LAST RUN
                              (S)AVE INPUT VALUES
                              (E)XIT THE PROGRAM
```

B. SAMPLE BILLET BREAKDOWN

```
    BILLET  NAME          NUMBER OF BILLETS      MAJ LTCOL COL

1.  JDA                        171               64   77   30
2.  JDA COS                     46               16   18   12
3.  JSO NOM                     60               33   27    0
4.  COS JSO NOM 3YR NOJPME      22               12   10    0
5.  COS JSO NOM 2YR NOJPME      32               16   16    0
6.  COS JSO NOM 2YR JPME        28               12   16    0
7.  JSO                         17                0    9    8
8.  CRITICAL                    58                0   28   30

  THE TOTAL NUMBER OF JDA BILLETS IS 434
          PERCENT JSO/JSO NOMINEE IS  50.00
PERCENT COS JSO NOMINEE WITHOUT JPME  12.44

TYPE THE NUMBER OF THE BILLET YOU WANT TO LOOK AT OR CHANGE
     OR HIT ENTER TO GO BACK TO THE MAIN MENU
```

C. SAMPLE RUN ANALYSIS

YEAR 3

SHORTAGE OF COS JSO'S NEEDED FOR CRITICAL BILLETS 3

SHORTAGE OF JSO'S NEEDED FOR CRITICAL BILLETS 4

SHORTAGE OF JSO'S FOR NON-CRITICAL BILLETS 3

NUMBER OF JPME SLOTS NEEDED THE YEAR PRIOR 34

NUMBER OF COLONELS ELIGIBLE FOR PROMOTION 17

AVERAGE TOUR 3.00 YEARS

NUMBER OF 2 YEAR COS OFFICERS ALLOWED FOR EXCLUSION 54.25
NUMBER OF 2 YEAR COS OFFICERS WHO LEFT A JDA BILLET 53
NUMBER OF 3 YEAR TOUR OFFICERS WHO LEFT A JDA BILLET 112

HIT ENTER TO CONTINUE

YEAR 3

JDA MANPOWER POOLS WHICH FILL CRITICAL AND JSO BILLETS

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26
JSO NOM	0	0	0	0	0	2	2	0	0	2	0	0	0	0
COS JSO NOM 2 YR NOJPME	0	0	0	0	2	0	0	0	0	2	0	0	0	0
COS JSO NOM 2 YR JPME	0	0	0	1	2	1	0	0	0	2	0	0	0	0

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26
CRITICAL BILLETS NOT FILLED	0	0	0	0	0	0	0	0	0	0	0	1	1	2
JSO BILLETS NOT FILLED	0	0	0	0	0	0	0	0	1	0	0	1	1	0

HIT ENTER TO CONTINUE

APPENDIX C. STRATEGY I BILLET INPUTS

A. BILLET FILL

	BILLET NAME	NUMBER OF BILLETS	MAJ	LTCOL	COL
1.	JDA	163	49	75	39
2.	JDA COS	54	24	20	10
3.	JSO NOM	95	48	47	0
4.	COS JSO NOM 3YR NOJPME	0	0	0	0
5.	COS JSO NOM 2YR NOJPME	54	32	22	0
6.	COS JSO NOM 2YR JPME	0	0	0	0
7.	JSO	10	0	9	1
8.	CRITICAL	58	0	28	30

THE TOTAL NUMBER OF JDA BILLETS IS 434
PERCENT JSO/JSO NOMINEE IS 50.00
PERCENT COS JSO NOMINEE WITHOUT JPME 12.44

TYPE THE NUMBER OF THE BILLET YOU WANT TO LOOK AT OR CHANGE
OR HIT ENTER TO GO BACK TO THE MAIN MENU

B. INDIVIDUAL CATEGORIES

JDA

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	5	5	6	0	0	8	8	9	0	0	6	6	0	0			
	5	6	6	0	0	8	8	9	0	0	6	8	0	0			
	5	5	6	0	0	8	8	9	0	0	7	6	0	0			
															49	75	39

JDA (COS)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	3	3	3	3	0	3	3	3	1	0	2	2	1	0			
	3	3	3	3	0	3	3	3	1	0	2	2	1	0			
															24	20	10

JSO NOM

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	1	8	7	0	0	5	5	5	0	0	0	0	0	0			
	1	8	7	0	0	6	5	5	0	0	0	0	0	0			
	1	8	7	0	0	6	5	5	0	0	0	0	0	0			
															48	47	0

COS JSO NOM (3YR-NOJPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
															0	0	0

COS JSO NOM (2YR-NOJPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	4	4	4	4	0	3	3	3	2	0	0	0	0	0			
	4	4	4	4	0	3	3	3	2	0	0	0	0	0			
															32	22	0

COS JSO NOM (2YR-JPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
															0	0	0

JSO

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	1	1	1	0	0	1	0	0	0			
	0	0	0	0	0	1	1	1	0	0	0	0	0	0			
	0	0	0	0	0	1	1	1	0	0	0	0	0	0			
															0	9	1

CRITICAL

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	3	3	3	0	0	5	5	0	0			
	0	0	0	0	0	3	3	3	0	0	4	6	0	0			
	0	0	0	0	0	3	3	4	0	0	5	5	0	0			
															0	28	30

APPENDIX D. STRATEGY IIA BILLET INPUTS

A. BILLET FILL

	BILLET NAME	NUMBER OF BILLETS	MAJ	LTCOL	COL
1.	JDA	171	64	77	30
2.	JDA COS	46	16	18	12
3.	JSO NOM	60	33	27	0
4.	COS JSO NOM 3YR NOJPME	22	12	10	0
5.	COS JSO NOM 2YR NOJPME	32	16	16	0
6.	COS JSO NOM 2YR JPME	28	12	16	0
7.	JSO	17	0	9	8
8.	CRITICAL	58	0	28	30

THE TOTAL NUMBER OF JDA BILLETS IS 434
PERCENT JSO/JSO NOMINEE IS 50.00
PERCENT COS JSO NOMINEE WITHOUT JPME 12.44

TYPE THE NUMBER OF THE BILLET YOU WANT TO LOOK AT OR CHANGE
OR HIT ENTER TO GO BACK TO THE MAIN MENU

B. INDIVIDUAL BILLET CATEGORIES

JDA

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	6	8	7	0	0	7	7	6	6	0	5	5	0	0			
	6	8	8	0	0	7	7	6	6	0	5	5	0	0			
	6	8	7	0	0	7	6	6	6	0	5	5	0	0			
															64	77	30

JDA (COS)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	2	2	2	2	0	3	2	2	2	0	2	2	2	0			
	2	2	2	2	0	3	2	2	2	0	2	2	2	0			
															16	18	12

JSO NOM

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	4	4	3	0	3	2	2	2	0	0	0	0	0			
	0	4	4	3	0	3	2	2	2	0	0	0	0	0			
	0	4	4	3	0	3	2	2	2	0	0	0	0	0			
															33	27	0

COS JSO NOM (3YR-NOJPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	2	2	0	0	2	2	1	0	0	0	0	0	0			
	0	2	2	0	0	0	2	0	0	0	0	0	0	0			
	0	2	2	0	0	2	0	1	0	0	0	0	0	0			
															12	10	0

COS JSO NOM (2YR-NOJPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	3	3	2	0	2	2	2	2	0	0	0	0	0			
	0	3	3	2	0	2	2	2	2	0	0	0	0	0			
															16	16	0

COS JSO NOM (2YR-JPME)

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	2	1	2	1	0	2	2	2	2	0	0	0	0	0			
	2	1	2	1	0	2	2	2	2	0	0	0	0	0			
															12	16	0

JSO

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	0	1	1	1	0	1	1	1	0			
	0	0	0	0	0	0	1	1	1	0	1	1	1	0			
	0	0	0	0	0	0	1	1	1	0	1	1	0	0			
															0	9	8

CRITICAL

YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	MAJ	LTCOL	COL
	0	0	0	0	0	3	3	2	2	0	3	3	2	2			
	0	0	0	0	0	3	2	2	2	0	3	3	2	2			
	0	0	0	0	0	3	2	2	2	0	3	3	2	2			
															0	28	30

APPENDIX E. STRATEGY IIB POOL INPUT

A. JDA POOL

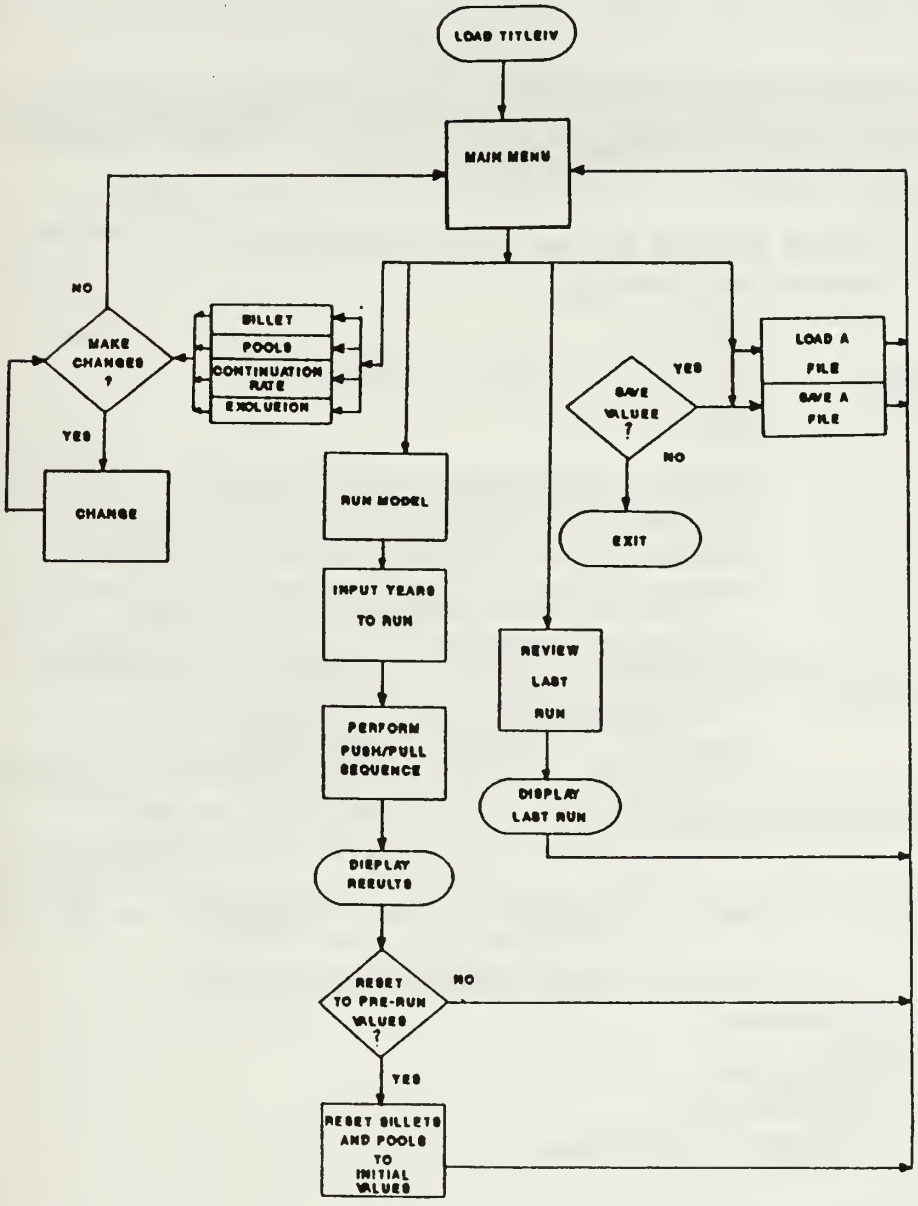
JDA POOL INCUMBENTS	YEAR 13	14	15	16	17	18	19	20	21	22	23	24	25	26
JDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JDA (COS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JSO NOM	1	6	8	36	26	42	67	52	61	51	49	87	39	48
COS JSO NOM (3YR-NOJPME)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COS JSO NOM (2YR-NOJPME)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COS JSO NOM (2YR-JPME)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JSO	0	0	0	0	0	0	0	0	0	0	0	0	0	0

B. BILLET CATEGORIES

	JSO NOM														MAJ	LTCOL	COL
YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26			
	0	4	7	0	0	4	5	2	0	0	0	0	0	0			
	0	4	7	0	0	4	5	2	0	0	0	0	0	0			
	0	4	7	0	0	4	5	2	0	0	0	0	0	0			
															33	33	0

	JSO														MAJ	LTCOL	COL
YCS	13	14	15	16	17	18	19	20	21	22	23	24	25	26			
	0	0	0	0	0	0	0	1	1	0	1	1	1	0			
	0	0	0	0	0	0	0	0	0	0	1	1	1	0			
	0	0	0	0	0	0	1	0	0	0	1	1	0	0			
															0	3	8

APPENDIX F. TITLEIV FLOWCHART



APPENDIX G. TITLEIV APL FUNCTIONS

A. MENU

```
∇MENU
      ∇MENU[⎕]∇
      ∇ MENU;W;CHANGE;KRES;APPERCENT;COLONEL;COSJPME;COSNOMTHREE;COSTWOJPME;COS
        TWONOJPME;CRITICAL;CRITICALFILLVECTOR;CRITICALNOTFILLED;CRITICALNUMBER;
        I;INCUMBENT;INPUT;JDA;JDACOS;JDAPOOL;JPMESLOTS;JSO;JSOBILLETFILLED;JSOF
        ILLVECTOR;JSONOM;JSONUMBER;KEYRESP;NAME;NAME1;EXCLUSION;NOTFILLED;PERCE
        NTCOS;POOLJSONOM;REQCOS;T;TEMP;YEAR;CR

    ⍝ SET THE SCREEN COLORS
     44 SCRCOLOR 37

    ⍝ MENU IS THE DRIVER FUNCTION FOR THE TITLE IV WORKSPACE.

    ⍝ THE LOCAL VARIABLES ARE DESCRIBED:

    ⍝ JDA                  3×14
    ⍝ JDACOS               2×14
    ⍝ JSONOM               3×14
    ⍝ COSNOMTHREE          3×14          JDA BILLET MATRICIES
    ⍝ COSTWONOJPME         2×14
    ⍝ COSTWOJPME           2×14
    ⍝ JSO                  3×14
    ⍝ CRITICAL             3×14
    ⍝
    ⍝ JDAPOOL              POOL OF JDA EXPERINCED MARINE OFFICERS  ( 7×14 )
    ⍝
    ⍝ CR                   CONTINUATION MATRIX   ( 14×14 )
    ⍝
    ⍝ APPERCENT            SHORTAGE OF COS JSO NOMINEES FOR CRITICAL BILLETS
    ⍝
    ⍝ EXCLUSION            PERCENT 2 YR COS OFFICERS ALLOWED TO BE EXCLUDED
    ⍝                          FROM THE YEARLY AVERAGING OF TOUR LENGTH
    ⍝
    ⍝ PERCENTCOS           APPROPRIATE PERCENTAGE OF 2 YR COS JSO NOMINEES
    ⍝                        REQUIRED TO BECOME JSO'S TO FILL CRITICAL BILLETS
    ⍝
    ⍝ CRITICALNOTFILLED    VECTOR WHICH SHOWS WHERE A SHORTAGE BY YCS A
    ⍝                        SHORTAGE EXISTS
    ⍝
    ⍝ REQCOS               NUMBER OF 2 YR COS JSO NOMINEES REQUIRED TO
    ⍝                        BECOME JSO'S TO FILL CRITICAL BILLETS
    ⍝
    ⍝ ALL GLOBAL VARIABLES USED HAVE A 'T' WHICH PRECEEDS THE VARIABLE
    ⍝ NAME THE GLOBAL REPRESENTS.
    ⍝
    ⍝

     NAME← 8 24 ρ'                    JDA                 JDA (COS)
          JSO NOMCOS JSO NOM (3YR-NOJPME)COS JSO NOM (2YR-NOJPME)  COS JSO NOM
      (2YR-JPME)                     JSO                 CRITICAL'

    ⍝ TRANSFER THE GLOBAL VARIABLE VALUES TO THE LOCAL VARIABLES

    L99:APPERCENT←TAPPERCENT
     COLONEL←TCOLONEL
     COSJPME←TCOSJPME
     COSNOMTHREE←TCOSNOMTHREE
     COSTWOJPME←TCOSTWOJPME
     COSTWONOJPME←TCOSTWONOJPME
     CRITICAL←TCRITICAL
     CRITICALNOTFILLED←TCRITICALNOTFILLED
     EXCLUSION←TEXCLUSION
     JDA←TJDA
     JDACOS←TJDACOS
     JDAPOOL←TJDAPOOL
     JPMESLOTS←TJPMESLOTS
     JSO←TJSO
     JSOBILLETFILLED←TJSOBILLETFILLED
     JSONOM←TJSONOM
     POOLJSONOM←TPOOLJSONOM
     YEAR←TYEAR
     CR←TCR
```

B. MENU (CONT'D)

```
[66] L0:CLRSCRN
[67]   '                                TITLE IV MENU'
[68]   ' '
[69]   ' '
[70]   'TYPE THE LETTER IN PARANTHESIS TO REVIEW, CHANGE OR RUN MODEL INPUTS'
[71]   '                               (G)ET A FILE'
[72]   '                               (B)ILLET FILL'
[73]   '                               (O)FFICER POOLS'
[74]   '                               (C)ONTINUATION RATES'
[75]   '                               (T)ITLE IV EXCLUSION PERCENTAGE'
[76]   '                               (R)UN MODEL'
[77]   '                               (L)OOK AT CURRENT INPUTS/ANALYSIS OF LAST RUN'
[78]   '                               (S)AVE INPUT VALUES'
[79]   '                               (E)XIT THE PROGRAM'
[80] L10:→('GBOCTRLSE'=1↑⍞)/L1,L2,L3,L4,L5,L6,L7,L8,L9
[81]   '
[82]   'ENTER ONLY G, B, O, P, T, R, L, S, E'
[83]   →L10
[84] L1:FILEOP
[85]   →L99
[86] L2:BILLFILL
[87]   →L0
[88] L3:INCUMB
[89]
[90]   →L0
[91] L4:PROMOT
[92]   →L0
[93] L5:TITLEIV
[94]   →L0
[95] L6:STARTRUN
[96]   CLRSCRN
[97]   'DO YOU WANT TO RESET THE BILLETS AND POOLS TO THEIR'
[98]   'INITIAL VALUE BEFORE THE MODEL WAS RUN ? '
[99]   '       TYPE ''Y'' TO RESET OR HIT ENTER TO CONTINUE'
[100]  →('Y'=1↑⍞)/L99
[101]  →L0
[102] L7:DISPLAY
[103]  →L0
[104] L8:SAVE
[105]  →L0
[106] L9:CLRSCRN
[107]   ' ONCE YOU EXIT ALL INPUT VALUES ARE LOST UNLESS YOU HAVE SAVED'
[108]   '                              THEM IN A FILE'
[109]   ' '
[110]   '   TYPE ''S'' IF YOU WANT TO SAVE YOUR INPUTS'
[111]   '                OR HIT ENTER TO EXIT'
[112]  KRES←RESPONSECHECK 'S'
[113]  →(KRES=1)⍴L8
[114]   ' '
[115]   ' '
[116]   '       DO YOU WANT TO REAMAIN IN APL?  TYPE ''Y'' TO STAY IN APL'
[117]  KRES←RESPONSECHECK 'Y'
[118]  →(KRES=1)⍴END
[119]  ⎕SA←'OFF'
[120] END:' '
[121]   '
[122]   '                          MODEL HAS BEEN EXITED'
[123]
[124]   '             TYPE   ''OFF'' TO LEAVE APL'
       ∇
```

C. BILLCHANGE

```
     ∇BILLCHANGE[□]∇
     ∇ TYPE BILLCHANGE BILLET;T;RESULT;NEW;RANK;MAJ;LTCOL;COL
[1]
[2]  ⍝ ALLOWS THE USER TO CHANGE A SPECIFIED BILLET CATEGORY.
[3]  ⍝ USED IN CONJUNCTION WITH THE FUNCTION BILLFILL.
[4]
[5]  L0:CLRSCRN
[6]
[7]  ⍝ CALCULATE THE NUMBER OF MAJORS,LTCOLS AND COLONELS
[8]  ⍝ WHICH MAKE UP THE BILLET FILL
[9]
[10]  RANK←+⌿BILLET
[11]  MAJ←+/RANK[⍳5]
[12]  LTCOL←+/RANK[5+⍳5]
[13]  COL←+/RANK[10+⍳4]
[14]  RANK←(⍕,'I5' □FMT MAJ,LTCOL,COL)
[15]  (15ρ' '),NAME[⍋TYPE;],(28ρ' '),'MAJ LTCOL COL'
[16]  'YCS  ',(⍕,'I4' □FMT(12+⍳14))
[17]  ' '
[18]  (((1+ρBILLET),5)ρ(NAME[(⍋TYPE);],((5×(1+ρBILLET)-1))ρ' ')),('I4' □FMT BIL
      LET)
[19]  (60ρ' '),RANK
[20]  ' '
[21] L1:'  DO YOU WANT TO MAKE ANY CHANGES TO THE BILLET FILL, Y OR N '
[22]  →('Y'≠1↑□)/END
[23]  ' '
[24]  '       WHICH YEAR DO YOU WANT TO CHANGE, ( 13 - 26 )  '
[25]  T←,□
[26]
[27]  →((∨/(T<13))∨(∨/((⌈T)≠T))∨(∨/((ρT)≠1))∨(T>26))ρL5
[28]  'YEAR ',(⍕T)
[29]  'I8' □FMT BILLET[;T-12]
[30]  ' '
[31]  '                INPUT THE NEW VALUES FOR YEAR ',(⍕T)
[32]  '                (',(⍕1+ρBILLET),' VALUES SEPERATED BY A SPACE)'
[33]  NEW←,□
[34]  RESULT←ERRCHECK NEW
[35]  →(RESULT=1)ρL5
[36]  BILLET[;T-12]←NEW
[37]  ZZZ←BILLET
[38]  →L0
[39] L5:NOGO
[40]  →L1
[41] END:ZZZ←BILLET
[42]  ∇
```

D. BILLFILL

```
      ∇BILLFILL[□]∇
      ∇ BILLFILL;TOTAL;N;ZZZ;T;MAJ;LTCOL;COL;RANK
[1]
[2]   ⍝ ALLOWS THE USER TO CHANGE JDA BILLETS AND GIVES A
[3]   ⍝ FIRST GLANCE INDICATION OF THE PERCENTAGE OF 2 YEAR
[4]   ⍝ COS JSO NOMINEES WITHOUT JPME THE USER HAS SELECTED.
[5]
[6]    MAJ←8⍴0
[7]    LTCOL←8⍴0
[8]    COL←8⍴0
[9]    RANK← 8 14 ⍴0
[10]
[11]
[12]  L0:CLRSCRN
[13]   TOTAL←(+/+/JDA)+(+/+/JDACOS)+(+/+/JSO)+(+/+/CRITICAL)+(+/+/JSONOM)+(+/+/C
      OSNOMTHREE)+(+/+/COSTWONOJPME)+(+/+/COSTWOJPME)
[14]
[15]  ⍝ CALCULATE THE NUMBER OF MAJORS, LTCOLS AND COLONELS IN EACH BILLET
[16]   RANK[1;]←+/JDA
[17]   RANK[2;]←+/JDACOS
[18]   RANK[3;]←+/JSONOM
[19]   RANK[4;]←+/COSNOMTHREE
[20]   RANK[5;]←+/COSTWONOJPME
[21]   RANK[6;]←+/COSTWOJPME
[22]   RANK[7;]←+/JSO
[23]   RANK[8;]←+/CRITICAL
[24]   MAJ[⍳8]←+/RANK[⍳8;⍳5]
[25]   LTCOL[⍳8]←+/RANK[⍳8;5+⍳5]
[26]   COL[⍳8]←+/RANK[⍳8;10+⍳4]
[27]
[28]
[29]
[30]   '     BILLET  NAME        NUMBER OF BILLETS      MAJ LTCOL COL '
[31]   ' '
[32]   '     1.  JDA                    ',(⍕,'I4' □FMT(+/+/JDA)),(12⍴' '),(⍕,'I5' □F
      MT MAJ[1],LTCOL[1],COL[1])
[33]   '     2.  JDA COS                ',(⍕,'I4' □FMT(+/+/JDACOS)),(12⍴' '),(⍕,'I5'
       □FMT MAJ[2],LTCOL[2],COL[2])
[34]   '     3.  JSO NOM                ',(⍕,'I4' □FMT(+/+/JSONOM)),(12⍴' '),(⍕,'I5'
       □FMT MAJ[3],LTCOL[3],COL[3])
[35]   '     4.  COS JSO 3YR NOJPME     ',(⍕,'I4' □FMT(+/+/COSNOMTHREE)),(12⍴' '),(⍕
      ,'I5' □FMT MAJ[4],LTCOL[4],COL[4])
[36]   '     5.  COS JSO 2YR NOJPME     ',(⍕,'I4' □FMT(+/+/COSTWONOJPME)),(12⍴' '),(
      ⍕,'I5' □FMT MAJ[5],LTCOL[5],COL[5])
[37]   '     6.  COS JSO 2YR JPME       ',(⍕,'I4' □FMT(+/+/COSTWOJPME)),(12⍴' '),(⍕,
      'I5' □FMT MAJ[6],LTCOL[6],COL[6])
[38]   '     7.  JSO                    ',(⍕,'I4' □FMT(+/+/JSO)),(12⍴' '),(⍕,'I5' □F
      MT MAJ[7],LTCOL[7],COL[7])
[39]   '     8.  CRITICAL               ',(⍕,'I4' □FMT(+/+/CRITICAL)),(12⍴' '),(⍕,'I
      5' □FMT MAJ[8],LTCOL[8],COL[8])
[40]   ' '
[41]   '     THE TOTAL NUMBER OF JDA BILLETS IS ',(⍕TOTAL)
[42]   '                PERCENT JSO/JSO NOMINEE IS ',(⍕,'F6.2' □FMT(100×(1-(((+/+/JD
      A)+(+/+/JDACOS))÷TOTAL))))
[43]   '   PERCENT COS JSO NOMINEE WITHOUT JPME ',(⍕,'F6.2' □FMT((100×((+/+/COSNO
      MTHREE)+(+/+/COSTWONOJPME))÷TOTAL)))
[44]   ' '
[45]   '   TYPE THE NUMBER OF THE BILLET YOU WANT TO LOOK AT OR CHANGE'
[46]   '          OR HIT ENTER TO GO BACK TO THE MAIN MENU'
[47]   →('12345678'=1↑□)/L1,L2,L5,L6,L7,L8,L3,L4
[48]   →0
[49]  L1:
[50]   '1' BILLCHANGE JDA
[51]   TJDA←JDA←ZZZ
[52]   →L0
[53]  L2:
[54]   '2' BILLCHANGE JDACOS
[55]   TJDACOS←JDACOS←ZZZ
[56]   →L0
[57]  L3:
[58]   '7' BILLCHANGE JSO
[59]   TJSO←JSO←ZZZ
[60]   →L0
[61]  L4:
[62]   '8' BILLCHANGE CRITICAL
[63]   TCRITICAL←CRITICAL←ZZZ
[64]   →L0
[65]  L5:
[66]   '3' BILLCHANGE JSONOM
[67]   TJSONOM←JSONOM←ZZZ
[68]   →L0
[69]  L6:
[70]   '4' BILLCHANGE COSNOMTHREE
[71]   TCOSNOMTHREE←COSNOMTHREE←ZZZ
[72]   →L0
[73]  L7:
[74]   '5' BILLCHANGE COSTWONOJPME
[75]   TCOSTWONOJPME←COSTWONOJPME←ZZZ
[76]   →L0
[77]  L8:
[78]   '6' BILLCHANGE COSTWOJPME
[79]   TCOSTWOJPME←COSTWOJPME←ZZZ
[80]   →L0
       ∇
```

E. DISPLAY

```
      ∇DISPLAY[□]∇
      ∇ DISPLAY;NAMES;H;TOTAL;NOTXCLUDED;EX;AVGTOUR;W;VACATE;COSVACATE
[1]
[2]   ⍝ THIS FUNCTION IS USED TO DISPLAY THE RESULTS OF A MODEL RUN.
[3]   ⍝ INFORMATION FROM THE MODEL RUNS ALLOWS THE USER TO CHECK
[4]   ⍝ HOW SUCCESSFUL A PARTICULAR BILLET FILL STRATEGY AND
[5]   ⍝ CONTINUATION RATE ARE WITH REGARD TO TITLE IV CONSTRAINTS.
[6]
[7]    CLRSCRN
[8]    NAMES←3 16⍴'          JSO NOM','COS  2 YR NOJPME','   COS 2 YR JPME'
[9]    H←'          YCS      13 14 15 16 17 18 19 20 21 22 23 24 25 26'
[10]   '                              YEAR ',(⍕YEAR)
[11]   ' '
[12]   ' '
[13]   'SHORTAGE OF COS JSO''S NEEDED FOR CRITICAL BILLETS  ',(⍕,'I6' □FMT(⌈APPE
       RCENT[YEAR;]))
[14]   ' '
[15]   'SHORTAGE OF JSO''S NEEDED FOR CRITICAL BILLETS      ',(⍕,'I6' □FMT(+/⌈CR
       ITICALNOTFILLED[YEAR;]))
[16]   ' '
[17]   'SHORTAGE OF JSO''S FOR NON-CRITICAL BILLETS         ',(⍕,'I6' □FMT(+/⌈JS
       OBILLETFILLED[YEAR;]))
[18]   ' '
[19]   'NUMBER OF JPME SLOTS NEEDED THE YEAR PRIOR         ',(⍕,'I6' □FMT COSJPM
       E+JPMESLOTS)
[20]   ' '
[21]   'NUMBER OF COLONELS ELIGIBLE FOR PROMOTION          ',(⍕,'I6' □FMT⌈COLONE
       L)
[22]
[23]  ⍝    THE FOLLOWING EQUATIONS CALCULATE THE AVERAGE TOUR LENGTH
[24]
[25]   TOTAL←(+/+/JDA)+(+/+/JDACOS)+(+/+/JSO)+(+/+/CRITICAL)+(+/+/JSONOM)+(+/+/C
       OSNOMTHREE)+(+/+/COSTWONOJPME)+(+/+/COSTWOJPME)
[26]   EX←TOTAL×(EXCLUSION÷100)
[27]   ' '
[28]   COSVACATE←(+/JDACOS[1;])+(+/COSTWONOJPME[1;])+(+/COSTWOJPME[1;])
[29]   NOTXCLUDED←⌈/(0,COSVACATE-EX)
[30]   VACATE←(+/JDA[1;])+(+/JSO[1;])+(+/JSONOM[1;])+(+/CRITICAL[1;])+(+/COSNOMT
       HREE[1;])
[31]   →((VACATE+NOTXCLUDED)=0)⍴L1
[32]   AVGTOUR←((3×VACATE)+(2×NOTXCLUDED))÷(VACATE+NOTXCLUDED)
[33]   '     AVERAGE TOUR ',(⍕,'F6.2' □FMT AVGTOUR),' YEARS'
[34]   ' '
[35]   'NUMBER OF 2 YEAR COS OFFICERS ALLOWED FOR EXCLUSION   ',(⍕EX)
[36]   'NUMBER OF 2 YEAR COS OFFICERS WHO LEFT A JDA BILLET   ',(⍕COSVACATE)
[37]   'NUMBER OF 3 YEAR TOUR OFFICERS WHO LEFT A JDA BILLET ',(⍕VACATE)
[38]   →PAGE
[39]  L1:'     NO OFFICERS LEFT A JDA BILLET IN THIS YEAR'
[40]  PAGE:' '
[41]   ' '
[42]   '                    HIT ENTER TO CONTINUE  '
[43]   W←□
[44]   CLRSCRN
[45]   '                                YEAR ',(⍕YEAR)
[46]   ' '
[47]   '        JDA MANPOWER POOLS WHICH FILL CRITICAL AND JSO BILLETS'
[48]   H
[49]   ' '
[50]   NAMES,'I3' □FMT⌊POOLJSONOM
[51]   ' '
[52]   ' '
[53]   H
[54]   ' '
[55]   →((+/CRITICALNOTFILLED[YEAR;])=0)⍴SKIP1
[56]   'CRITICAL BILLETS'
[57]   '   NOT FILLED   ',(⍕,'I3' □FMT⌈CRITICALNOTFILLED[YEAR;])
[58]   ' '
[59]  SKIP1:→((+/JSOBILLETFILLED[YEAR;])=0)⍴SKIP2
[60]   'JSO BILLETS'
[61]   '   NOT FILLED   ',(⍕,'I3' □FMT(⌈JSOBILLETFILLED[YEAR;]))
[62]  SKIP2:' '
[63]   ' '
[64]   'HIT ENTER TO CONTINUE'
[65]   W←□
[66]   CLRSCRN
       ∇
```

F. INCUMB

```
      ∇INCUMB[⎕]∇
      ∇ INCUMB;T;NEW;RESULT
[1]
[2]
[3]   ⍝ ALLOWS THE USER TO LOOK AND CHANGE THE NUMBER OF
[4]   ⍝ OFFICERS IN JDA POOLS WHO HAVE JDA EXPERIENCE.
[5]
[6]   L0:CLRSCRN
[7]    '                                          YCS'
[8]    '                    ',(⍕,'I4' ⎕FMT(12+⍳14))
[9]    'JDA POOL INCUMBENTS'
[10]   ' '
[11]   NAME[1 2 3 5 6 7 8 ;],('I4' ⎕FMT JDAPOOL)
[12]   ' '
[13]   ' '
[14]  L1:'DO YOU WANT TO MAKE ANY CHANGES TO THE INCUMBENTS MATRIX, Y TO CHANGE'
[15]   →('Y'≠1↑⎕)/END
[16]   ' '
[17]   ' '
[18]   '    WHICH YEAR DO YOU WANT TO CHANGE ( 13-26 )'
[19]   T←,⎕
[20]   →((∨/(T<13))∨(∨/((⌈T)≠T))∨(∨/((⍴T)≠1))∨(T>26))⍴L5
[21]   '      YEAR   ',(⍕T)
[22]   NAME[1 2 3 4 5 6 7 ;],('I8' ⎕FMT JDAPOOL[;T-12])
[23]   ' '
[24]   ' '
[25]   'INPUT THE NEW VALUES FOR YEAR ',(⍕T)
[26]   '(',(⍕1↑⍴JDAPOOL),' VALUES SEPERATED BY A SPACE)'
[27]   NEW←,⎕
[28]   RESULT←ERRCHECK1 NEW
[29]   →(RESULT=1)⍴L5
[30]   TJDAPOOL[;T-12]←JDAPOOL[;T-12]←NEW
[31]   →L0
[32]  L5:NOGO
[33]   →L1
[34]  END:
      ∇
```

G. PROMOT

```
      ∇PROMOT[□]∇
      ∇ PROMOT;T;NEW;RESULT
[1]   ⍝ THIS FUNCTION ALLOWS THE USER TO CHANGE THE CONTINUATION
[2]   ⍝ RATES OF OFFICERS FROM ONE YCS TO THE NEXT.
[3]
[4]   L0:CLRSCRN
[5]     ' '
[6]     ' '
[7]     '           CONTINUATION RATE'
[8]     ' '
[9]     ' '
[10]    '                                    YCS'
[11]    ,'I6' □FMT(12+⍳13)
[12]    ,'F6.3' □FMT 1↓++⌿CR
[13]    ' '
[14]    ' '
[15]  L1:' DO YOU WANT TO CHANGE ANY OF THE CONTINUATION RATES,  Y OR N '
[16]    →('Y'≠1↑□)⍴END
[17]    ' '
[18]    'WHICH YEAR DO YOU WANT TO CHANGE  ( 13 - 26 )'
[19]    T←,□
[20]    →((∨/(T<13))∨(∨/((⌈T)≠T))∨(∨/((⍴T)≠1))∨(T>26))⍴L5
[21]    '      YEAR ',(⍕T),'     CONTINUATION RATE ',(⍕,'F6.3' □FMT CR[T-12;T-11])
[22]    ' '
[23]    ' '
[24]    'ENTER THE NEW CONTINUATION RATE'
[25]    NEW←,□
[26]    RESULT←ERRCHECK2 NEW
[27]    →(RESULT=1)⍴L5
[28]    TCR[T-12;T-11]←CR[T-12;T-11]←NEW
[29]    →L0
[30]  L5:NOGO
[31]    →L1
[32]  END:
      ∇
```

H. MODEL

```
      ∇MODEL[□]∇
      ∇ MODEL
[1]   ⍝ THIS FUNCTION UPDATES THE OFFICERS WITH JDA EXPERIENCE
[2]   ⍝ BY ATTRITION  AND PROMOTION. THE REQUIRED NUMBER OF
[3]   ⍝ JPME GRADUATES IS CALCULATED FOR EACH YEAR THE MODEL
[4]   ⍝ IS RUN AND FILLS THE JSO AND CRITICAL JDA BILLETS
[5]   ⍝ FROM JSO NOMINEES AND COS JSO NOMINEES.
[6]   ⍝
[7]   ⍝ CALCULATE THE NUMBER OF COLONELS ELIGIBLE FOR PROMOTION
[8]   ⍝ TO BRIGADIER.
[9]    COLONEL←(+/JDAPOOL[;14])+JSO[2;13]+JSO[1;14]+CRITICAL[2;13]+CRITICAL[2;14
      ]
[10]
[11]  ⍝
[12]  ⍝ PUSH OFFICERS IN THE POOLS TO THE NEXT YEAR.  ATTRITION
[13]  ⍝ BETWEEN EACH YEAR AND PROMOTIONS ARE ACCOUNTED FOR BY THE
[14]  ⍝ CONTINUATION MATRIX.
[15]
[16]   JDAPOOL←JDAPOOL+.×CR
[17]
[18]
[19]  ⍝ CALCULATE THE JPME SLOTS NEEDED FROM THE PREVIOUS YEAR TO
[20]  ⍝ FILL THE JDA BILLET NEEDS FOR THIS CURRENT YEAR.
[21]   JPMESLOTS←(+/JSONOM[3;])+(+/COSTWOJPME[2;])
[22]
[23]  ⍝ SET THE NUMBER OF JPME SLOTS REQUIRED FOR COS OFFICERS NOMINATED
[24]  ⍝ AS JSO'S WHO NEED JPME AT ZERO.
[25]   COSJPME←0
[26]
[27]  ⍝CALCULATE THE NUMBER OF JSO SLOTS NEEDED TO BE FILLED.  THESE
[28]  ⍝ SLOTS ARE JDA BILLETS FILLED BY JSO'S.
[29]   JSONUMBER←+/JSO[3;]
[30]
[31]  ⍝ CALCULATE THE NUMBER OF CRITICAL BILLETS THAT NEED TO BE FILLED
[32]  ⍝ THIS YEAR.
[33]   CRITICALNUMBER←+/CRITICAL[3;]
[34]
[35]  ⍝ CALCULATE THE 'APPROPRIATE' PERCENTAGE OF COS OFFICERS WHO MUST
[36]  ⍝ FILL CRITICAL BILLETS AS JSO'S.
[37]   PERCENTCOS←(+/+/JDAPOOL[5 6 ;])÷(+/+/JDAPOOL[3 5 6 ;])
[38]
[39]  ⍝ CALCULATE THE NUMBER OF COS OFFICERS WHO MUST BECOME JSO'S
[40]   REQCOS←⌈(PERCENTCOS×CRITICALNUMBER)
[41]
[42]  ⍝ USE TEMPORARY VECTORS FOR TRACKING THE NUMBER OF JSO AND COS NOMINEE
[43]  ⍝ OFFICERS FILLING THE BILLETS
[44]   CRITICALFILLVECTOR←CRITICAL[3;]
[45]   JSOFILLVECTOR←JSO[3;]
[46]
[47]  ⍝ START THE LOOP FOR FILLING CRITICAL BILLETS WITH THE APPROPRIATE
[48]  ⍝ PERCENTAGE OF COS OFFICERS (2 YEAR COS JSO NOMINEE'S)
[49]  LOOP:I←15
[50]  LOOPA:I←I-1
[51]
[52]  ⍝ IF THE CRITICAL BILLETS ARE FILLED, GO TO L1
[53]   →(CRITICALFILLVECTOR[I]≤0)⍴L1
[54]   →(REQCOS=0)⍴CRITICALJSONOM
[55]  ⍝ CHECK TO SEE IF THERE ARE COS OFFICERS AVAILABLE TO FILL
[56]  ⍝ CRITICAL BILLETS, IF SO GO TO COSA OR COSB
[57]   →((JDAPOOL[5;I]≥JDAPOOL[6;I])∧(JDAPOOL[5;I]≥1))⍴COSA
[58]   →((JDAPOOL[5;I]<JDAPOOL[6;I])∧(JDAPOOL[6;I]≥1))⍴COSB
[59]   →LOOPA
[60]
[61]  COSA:CRITICALFILLVECTOR[I]←CRITICALFILLVECTOR[I]-1
[62]   JDAPOOL[5;I]←JDAPOOL[5;I]-1
[63]   REQCOS←REQCOS-1
[64]   →LOOPA
[65]
[66]  COSB:CRITICALFILLVECTOR[I]←CRITICALFILLVECTOR[I]-1
[67]   JDAPOOL[6;I]←JDAPOOL[6;I]-1
[68]   REQCOS←REQCOS-1
[69]   →LOOPA
[70]
[71]  ⍝ IF THE NUMBER OF COS OFFICER NEEDED TO FILL CRITICAL BILLETS
[72]  ⍝ FOR THIS YEAR HAS BEEN MET, START FILLING CRITICAL BILLETS
[73]  ⍝ WITH JSO NOMINEES
[74]  L1:→(REQCOS=0)⍴CRITICALJSONOM
[75]   →(I≤1)⍴LOOP
[76]   →((+/((JDAPOOL[5;]≥1)∨(JDAPOOL[6;]≥1))∧(CRITICALFILLVECTOR≥1))>0)⍴LOOPA
[77]  CRITICALJSONOM:APPERCENT[YEAR;]←REQCOS
[78]   I←1
[79]
[80]  LOOP3:I←I+1
[81]   →(I>14)⍴JSOFILL
[82]   →(JDAPOOL[3;I]<CRITICALFILLVECTOR[I])⍴PROB2
```

```
[83]   JDAPOOL[3;I]←JDAPOOL[3;I]-CRITICALFILLVECTOR[I]
[84]   CRITICALFILLVECTOR[I]←0
[85]   →LOOP3
[86]
[87]  PROB2:CRITICALFILLVECTOR[I]←CRITICALFILLVECTOR[I]-JDAPOOL[3;I]
[88]   JDAPOOL[3;I]←0
[89]   →LOOP3
[90]
[91]  JSOFILL:CRITICALNOTFILLED[YEAR;]←CRITICALFILLVECTOR
[92]   I←5
[93]  LOOP4:I←I+1
[94]   →(I>14)ρDONE
[95]   →(JDAPOOL[3;I]<JSOFILLVECTOR[I])ρPROB3
[96]   JDAPOOL[3;I]←JDAPOOL[3;I]-JSOFILLVECTOR[I]
[97]   JSOFILLVECTOR[I]←0
[98]   →LOOP4
[99]
[100]  PROB3:JSOFILLVECTOR[I]←JSOFILLVECTOR[I]-JDAPOOL[3;I]
[101]   JDAPOOL[3;I]←0
[102]   →LOOP4
[103]
[104]  ⍝ DATA VECTOR ON THE NUMBER OF BILLETS NOT FILLED BY JSOS
[105]  DONE:JSOBILLETFILLED[YEAR;]←JSOFILLVECTOR
[106]
[107]  ⍝ FORM MARTIX OF JSO NOM AND 2 YR COS NOM FOR REPORT GENERATION
[108]   POOLJSONOM[1;]←JDAPOOL[3;]
[109]   POOLJSONOM[2;]←JDAPOOL[5;]
[110]   POOLJSONOM[3;]←JDAPOOL[6;]
[111]
[112]  ⍝ ADD OFFICERS WHO HAVE VACATED BILLETS THIS YEAR TO
[113]  ⍝ THE MANPOWER POOLS
[114]   TEMP←7 14 ρ0,0,JDA[3;⍳12],0,JDACOS[2;⍳13],0,0,JSONOM[3;⍳12],0,0,COSNOMT
        HREE[3;⍳12],0,COSTWONOJPME[2;⍳13],0,0,COSTWOJPME[2;⍳13],0,0,(JSO[3;⍳12]+CR
        ITICAL[3;⍳12])
[115]   JDAPOOL←JDAPOOL+(TEMP+.×CR)
[116]
[117]  ⍝ SHIFT JDA BILLET MATRICES BY ONE YEAR
[118]
[119]   JDA←¯1⊖JDA
[120]   JDACOS←¯1⊖JDACOS
[121]   JSO←¯1⊖JSO
[122]   JSONOM←¯1⊖JSONOM
[123]   CRITICAL←¯1⊖CRITICAL
[124]   COSNOMTHREE←¯1⊖COSNOMTHREE
[125]   COSTWONOJPME←¯1⊖COSTWONOJPME
[126]   COSTWOJPME←¯1⊖COSTWOJPME
        ∇
```

J. STARTRUN

```
      ∇STARTRUN[□]∇
      ∇ STARTRUN;TRUTH;W
[1]
[2]   ⍝ ASKS THE USER HOW MANY YEARS TO FORECAST AND ALLOWS
[3]   ⍝ THE USER THE OPTION OF VIEWING YEARLY RESULTS.
[4]
[5]    CLRSCRN
[6]    TRUTH←0
[7]    YEAR←0
[8]   L0:'INPUT THE NUMBER OF YEARS (INTEGER ONLY) YOU WISH TO FORECAST'
[9]    T←□
[10]   JSOBILLETFILLED←(T,14)⍴0
[11]   CRITICALNOTFILLED←(T,14)⍴0
[12]   APPERCENT←(T,1)⍴0
[13]   →((∨/(T<0))∨(∨/((⌈T)≠T))∨((⍴T)≠1))⍴L5
[14]   →(T=1)⍴L1
[15]   'SEE THE YEARLY RESULTS DISPLAYED (''Y'' OR HIT ENTER TO SKIP)'
[16]   KEYRESP←RESPONSECHECK 'Y'
[17]   →(KEYRESP≠1)⍴L1
[18]   TRUTH←1
[19]  L1:YEAR←YEAR+1
[20]   →(YEAR>T)⍴L2
[21]   '                    COMPUTING YEAR ',(⍕YEAR)
[22]   MODEL
[23]   →((∨/(TRUTH=1))∨(T=YEAR))⍴L3
[24]   →L1
[25]  L3:DISPLAY
[26]   →L1
[27]  L5:NOGO
[28]   →L0
[29]  L2:YEAR←T
      ∇
```

K. TITLEIV

```
      ∇TITLEIV[□]∇
      ∇ TITLEIV;NEW;RESULT
[1]
[2]   ⍝ ALLOWS THE USER TO CHANGE THE PERCENTAGE OF 2 YEAR COS OFFICERS
[3]   ⍝ WHICH CAN BE EXCLUDED FROM THE YEARLY AVERAGING OF TOUR LENGTHS.
[4]
[5]   L0:CLRSCRN
[6]    ' '
[7]    ' '
[8]    '       COS EXCLUSION FROM AVERAGING IS PRESENTLY',(⍕,'F6.2' ⎕FMT EXCLUSIO
       N),' %'
[9]    ' '
[10]   ' '
[11]   ' DO YOU WANT TO CHANGE THE EXCLUSION PERCENTAGE, Y OR N'
[12]   →('Y'≠1↑⎕)⍴END
[13]  L1:'ENTER THE NEW EXCLUSION RATE'
[14]   NEW←⍎⎕
[15]   RESULT←ERRCHECK3 NEW
[16]   →(RESULT=1)⍴L5
[17]   TEXCLUSION←EXCLUSION←NEW
[18]   →L0
[19]  L5:NOGO
[20]   →L1
[21]  END:
      ∇
```

L. FILE OPERATIONS

1. FILEOP

```
      ∇FILEOP[□]∇
      ∇ FILEOP;HEAD
[1]
[2]   ⍝ ALLOWS THE USER TO SELECT FROM ONE OF FOUR FILES WHICH
[3]   ⍝ CONTAIN USER INPUTS FOR BILLET FILL, POOLS AND CONTINUATION RATES.
[4]
[5]    □FUNTIE 1
[6]    CLRSCRN
[7]    'FILL1' □FTIE 1
[8]    HEAD←□FREAD 1 1
[9]    □FUNTIE 1
[10]   'FILE 1 TITLE IS ',HEAD
[11]   'FILL2' □FTIE 1
[12]   HEAD←□FREAD 1 1
[13]   □FUNTIE 1
[14]   'FILE 2 TITLE IS ',HEAD
[15]   'FILL3' □FTIE 1
[16]   HEAD←□FREAD 1 1
[17]   □FUNTIE 1
[18]   'FILE 3 TITLE IS ',HEAD
[19]    'FILL4' □FTIE 1
[20]   HEAD←□FREAD 1 1
[21]   □FUNTIE 1
[22]   'FILE 4 TITLE IS ',NAME
[23]   ' '
[24]   ' '
[25]   '      WHICH FILE DO YOU WANT TO RETRIEVE'
[26]   '    TYPE 1, 2, 3 OR 4    FOR FILES 1,2,3,4  OR'
[27]   '       ENTER ENTER TO EXIT TO MAIN MENU'
[28]   →('1234'=1↑□)/L1,L2,L3,L4
[29]   →END
[30]  L1:'FILL1' □FTIE 1
[31]   →L5
[32]
[33]  L2:'FILL2' □FTIE 1
[34]   →L5
[35]
[36]  L3:'FILL3' □FTIE 1
[37]   →L5
[38]
[39]  L4:'FILL4' □FTIE 1
[40]
[41]  L5:TAPPERCENT←□FREAD 1 1
[42]   TCOLONEL←□FREAD 1 2
[43]   TCOSJPME←□FREAD 1 3
[44]   TCOSNOMTHREE←□FREAD 1 4
[45]   TCOSTWOJPME←□FREAD 1 5
[46]   TCOSTWONOJPME←□FREAD 1 6
[47]   TCR←□FREAD 1 7
[48]   TCRITICAL←□FREAD 1 8
[49]   TCRITICALNOTFILLED←□FREAD 1 9
[50]   TE1CLUSION←□FREAD 1 10
[51]   TJDA←□FREAD 1 11
[52]   TJDACOS←□FREAD 1 12
[53]   TJDAPOOL←□FREAD 1 13
[54]   TJPMESLOTS←□FREAD 1 14
[55]   TJSO←□FREAD 1 15
[56]   TJSOBILLETFILLED←□FREAD 1 16
[57]   TJSONOM←□FREAD 1 17
[58]   TPOOLJSONOM←□FREAD 1 18
[59]   TYEAR←□FREAD 1 19
[60]   □FUNTIE 1
[61]  END:
      ∇
```

2. SAVE

```
      ∇SAVE[□]∇
      ∇ SAVE;TITLE
[1]
[2]   ⍝ ALLOWS THE USER TO SAVE DATA TO BE USED AT A LATTER TIME.
[3]   ⍝ THE BILLETS, POOLS, CONTINUATION RATES AND EXCLUSION ARE SAVED
[4]
[5]    □FUNTIE
[6]    CLRSCRN
[7]     'FILL1' □FTIE 1
[8]     TITLE←□FREAD 1 1
[9]     □FUNTIE 1
[10]  'FILE 1 TITLE IS ',TITLE
[11]    'FILL2 '□FTIE 1
[12]    TITLE←□FREAD 1 1
[13]    □FUNTIE 1
[14]  'FILE 2 TITLE IS ',TITLE
[15]    'FILL3' □FTIE 1
[16]  □FUNTIE 1
[17]    TITLE←□FREAD 1 1
[18]  □FUNTIE 1
[19]  'FILE 3 TITLE IS ',TITLE
[20]    'FILL4' □FTIE 1
[21]    TITLE←□FREAD 1 1
[22]    □FUNTIE 1
[23]  'FILE 4 TITLE IS ',TITLE
[24]  ''
[25]  'WHICH FILE DO YOU WANT TO USE TO SAVE YOUR INPUTS'
[26]  ' TYPE 1, 2, 3 OR 4    FOR FILES 1,2,3,4  OR'
[27]  '              ENTER TO EXIT TO MAIN MENU'
[28]   →('1234'=1↑□)/L1,L2,L3,L4
[29]   →END
[30]  L1:'FILL1' □FTIE 1
[31]   →L5
[32]
[33]  L2:'FILL2' □FTIE 1
[34]   →L5
[35]
[36]  L3:'FILL3' □FTIE 1
[37]   →L5
[38]
[39]  L4:'FILL4' □FTIE 1
[40]
[41]  L5:'       PRESENT TITLE FOR THE FILE IS'
[42]    THEADING←□FREAD 1 1
[43]    '              ',THEADING
[44]
[45]    'DO YOU WANT TO CHANGE THE FILE TITLE? TYPE ''Y'' TO CHANGE TITLE'
[46]
[47]    →('Y'≠1↑□)⍴L6
[48]    'TYPE THE NEW FILE TITLE, USE 60 CHARACTERS OR LESS'
[49]    THEADING←60↑□
[50]
[51]
[52]
[53]  L6:'SAVING THE FILE AS ',THEADING
[54]    TAPPERCENT □FREPLACE 1 1
[55]    TCOLONEL □FREPLACE 1 2
[56]    TCOSJPME □FREPLACE 1 3
[57]    TCOSNOMTHREE □FREPLACE 1 4
[58]    TCOSTWOJPME □FREPLACE 1 5
[59]    TCOSTWONOJPME □FREPLACE 1 6
[60]    TCR □FREPLACE 1 7
[61]    TCRITICAL □FREPLACE 1 8
[62]    TCRITICALNOTFILLED □FREPLACE 1 9
[63]    TEXCLUSION □FREPLACE 1 10
[64]    TJDA □FREPLACE 1 11
[65]    TJDACOS □FREPLACE 1 12
[66]    TJDAPOOL □FREPLACE 1 13
[67]    TJPMESLOTS □FREPLACE 1 14
[68]    TJSO □FREPLACE 1 15
[69]    TJSOBILLETFILLED □FREPLACE 1 16
[70]    TJSONOM □FREPLACE 1 17
[71]    TPOOLJSONOM □FREPLACE 1 18
[72]    TYEAR □FREPLACE 1 19
[73]    □FUNTIE 1
[74]  END:
      ∇
```

M. ERROR AND SCREEN FUNCTIONS

```
      ∇ERRCHECK[□]∇
      ∇ RESULT←ERRCHECK INPUT
[1]   →((∨/(INPUT<0))∨(∨/((⌈INPUT)≠INPUT))∨((⍴INPUT)≠(1+⍴BILLET)))⍴L1
[2]   RESULT←0
[3]   →0
[4]  L1:RESULT←1
      ∇


      ∇ERRCHECK1[□]∇
      ∇ RESULT←ERRCHECK1 INPUT
[1]   →((∨/(INPUT<0))∨(∨/((⌈INPUT)≠INPUT))∨((⍴INPUT)≠(1+⍴JDAPOOL)))⍴L5
[2]   RESULT←0
[3]   →0
[4]  L5:RESULT←1
      ∇


      ∇ERRCHECK2[□]∇
      ∇ RESULT←ERRCHECK2 INPUT
[1]   →(INPUT<0)⍴L1
[2]   →(INPUT>1)⍴L1
[3]   INPUT←,INPUT
[4]   →((⍴INPUT)>1)⍴L1
[5]   RESULT←0
[6]   →L2
[7]  L1:RESULT←1
[8]  L2:
      ∇


      ∇ERRCHECK3[□]∇
      ∇ RESULT←ERRCHECK3 INPUT
[1]   →(INPUT<0)⍴L1
[2]   →(INPUT>100)⍴L1
[3]   INPUT←,INPUT
[4]   →((⍴INPUT)>1)⍴L1
[5]   RESULT←0
[6]   →L2
[7]  L1:RESULT←1
[8]  L2:
      ∇


      ∇CLRSCRN[□]∇
      ∇ CLRSCRN
[1]   □TCFF
[2]


      ∇SCRCOLOR[□]∇
      ∇ FORE SCRCOLOR BACK;BITE;CLSCREEN
[1]   BITE←(8⍴2)⊤0⌈256⌊1+BACK
[2]   0 0 ⍴((⍳8⍴2)⊥BITE), 0 0 985)□CALL □AV[□IO+ 238 203]
[3]   0 0 25 80 □WPUT CLRSCREEN←FORE+BACK+15
[4]   0 0 ⍴CLRSCREEN □POKE 161
      ∇


      ∇NOGO[□]∇
      ∇ NOGO;W
[1]   'YOU HAVE ENTERED AN IMPROPER VALUE FOR THE DATA REQUESTED'
[2]   'HIT ENTER TO START AGAIN'
[3]   W←□
      ∇


      ∇RESPONSECHECK[□]∇
      ∇ KEYRESP←RESPONSECHECK INP;W
[1]  L0:W←□
[2]  L1:→(⍴W)=0)⍴L2
[3]   →(+/(INP≠W))⍴L3
[4]   KEYRESP←1
[5]   →0
[6]  L2:KEYRESP←0
[7]   →0
[8]  L3:'YOU HAVE TYPED AN IMPROPER RESPONSE'
[9]   'TYPE EITHER ',INP,' AND HIT ENTER ; OR HIT ENTER ONLY'
[10]  →L0
      ∇
```

APPENDIX H. TITLE IV USERS GUIDE

A. INTRODUCTION

TITLE IV is an interactive, menu driven program written in APL (A Programming Languge) to be used as a decision aid for Marine Corps Manpower managers in forecasting compliance to Title IV regulations. The model simulates filling JDA billets and joint manpower pools of Marine officers with previous JDA experience from 13-26 years of commissioned service (YCS). The user can change how the eight JDA billet categories are filled and update any of the seven joint manpower pools. Once the user is satisfied with the inputs selected, the user selects the number of years to forecast. After the model has run, information on how the user's inputs complied with Title IV constraints are displayed.

B. LOADING

The entire model is loaded on a standard 360K disk and is designed specifically to be run on an IBM PC. By typing "TITLEIV" the menu driven APL program is loaded and the TITLE IV main menu displayed.

C. MAIN MENU

The main menu is available for the user to change inputs for billets, manpower pools, continuation rates and the exclusion percentage. By typing the letter showing in paranthesis in the Main Menu the user selects the option desired. At the completion of each option, except for exiting the program, the main menu is redisplayed. Menu options are:

1. GET A FILE

   The user has four seperate APL files from which to retrieve previous data. This makes it possible for up to four different strategies to be kept close at hand for quick retrieval. By typing the number of the file requested the values from the selected files become the current values for the model.

2. BILLET FILL

   Upon selection of this option the user is shown the eight JDA billet categories and the number of billets in each category. Additional information is displayed concerning the total number of billets, the percentage of JSO JSO nominees (including COS JSO nominees) which make up the total billet fill and the percentage of COS JSO nominees who do not have JPME. If the user desires to look at or change a billet category, input the number of the category corresponding to the billet desired at the cursor prompt. The model will then show the billet category matrix consisting of columns 13-26 which corresponds to the YCS of when an of-

ficer would start the billet. The rows correspond to the tour length, in years, of the billet. Thus the first row of the billet represents the first year of the tour and successive rows represent the second and possibly third year of the billet. If a change to the billet fill is needed, type 'Y' and the model will now request which YCS column to be changed. Type the desired YCS column and enter the changes. The model will then redisplay the billet category matrix with the change incorporated.

3. OFFICER POOLS

At the user's request the seven officer pools are displayed. Entries in the pools represent the number of officers in each pool for a specific YCS. If changes to the pools are desired, type 'Y' and select the YCS to be changed. Type the new values corresponding to the seven pools listed at the prompt.

4. CONTINUATION RATES

The continuation rates for each YCS are displayed. YCS 17 and 22 correspond to promotions from major to lieutenant colonel and lieutenant colonel to colonel. If a change is to be made type 'Y' and enter the YCS to be changed. At the prompt enter the new rate. The rate must be a number between zero and one or else an error will occur.

5. TITLE IV EXCLUSION PERCENTAGE

The user is given the option of changing the percentage of COS officers who complete a two year billet tour who can be excluded from the yearly averaging of tour lengths. The current Title IV exclusion is 12.5%. If a change in the percentage is to be made, type 'Y' and enter the new percentage.

6. RUN MODEL

The user is asked to enter the number of years to forecast, which must be a positive integer number. If the forecast year is more than one year, the user is asked if the intervening years' results are to be displayed to the user as well.

The results of a run for each year are displayed in two screen frames. Frame one shows the user any shortages in filling the **CRITICAL** billet categories with COS officers from the two COS JSO nominee pools and also any shortages in filling **CRITICAL** and **JSO** billet categories with officers from the JSO nominee pool. A shortage means there is a shortage of officers with specific YCS in the JSO nominee manpower pool for the demand placed on the pool to fill a billet requiring a JSO. Additional information is displayed showing the number of colonels who would be considered eligible for promotion to general, the number of JPME slots needed to fill the year's billets with qualified officers, and information on the number of billets vacated the previous year.

Frame two shows the **CRITICAL** and **JSO** billet categories by YCS that were not filled and the JSO nominee and COS JSO nominee pools from which the **CRITICAL** and **JSO** billets pull officers. After the completion of frame two the user is asked if the billets and pools are to be reset to their values before the model was run. If the answer is 'N' the changes that occurred from running the model become the current values of the model.

7. LOOK AT CURRENT INPUTS/ANALYSIS OF LAST RUN

This is the same information displayed to the user in RUN MODEL, giving the user information from the last model run.

8. SAVE INPUT

Allows the user to save inputs to a file for latter use. Type the number of the file which is to receive the data.

9. EXIT

The user is prompted whether the current values are to be saved. If the user wants to save the data, type 'S' and the SAVE INPUT routine listed above is entered. If the user types 'N' or hits enter, the user is asked if the computer's system is to remain in the APL workspace or return to DOS.

D. ANALYSIS OF OUTPUT

When the model shows there is a shortage in the COS JSO nominee pools to fill CRITICAL billets or a shortage in the JSO nominee pool to fill CRITICAL or JSO billets for the forecast year, there are several options available to the user to see if these billets can be filled by qualified officers without resorting to using officers. who require waivers to fill the billets.

1. Find the YCS where there is a supply in the manpower pool or pools of officers eligible to become JSO's. These are pools 3, 5 and 6 within the model. Change the YCS of the billet category which is experiencing a shortage, to the YCS which corresponds to a supply of officers from a manpower pool sufficient to meet the demand.
2. Change the continuation rate or rates to increase the supply of officers in the manpower pools.
3. Increase the number of billets for the JSO nominee and COS JSO nominee billet categories so more officers enter the manpower pools after completing their JDA tour.
4. Select some combination from the above list.

E. MODEL BLOWS UP

If there exist any bugs in the program which cause the program to interrupt or malfunction, the user will find the program stops and the PC is now in the APL workspace. The APL status line at the lower part of the screen will show the words "SUSP". To clear the suspension enter ")SIC" and then type 'MENU' to restart the program. On keyboards without the APL character set displayed on the keys themselves, the ')' is the quote key on standard keyboards.

F. CONCLUSION

This model represents one tool the manpower manager can use to conduct "what if" type analyses concerning Title IV of the Goldwater-Nichols Act. The model is straight forward and easy to use and presents the information a manpower manager needs as an aid for decision making. The insight gained from using this program should prove beneficial to the Marine Corps.

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